ENVIRONMENTAL ASSESSMENT REPORT BASF CORPORATION- SOUTH WORKS WYANDOTTE, MICHIGAN

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The ERM Group

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Note: All appendices are provided on microfiche.

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SECTION 1
INTRODUCTION

The BASF Corporation South Works Site has a long history of industrial use. The 84-acre Site is bounded by Pine Street on the north, Wye Street to the south, the Detroit River to the east, and Biddle Avenue to the west. It was initially developed in 1895, and through 1980 was the location of numerous manufacturing operations. Historically, the property was covered with buildings, roadways, parking lots and docks. In 1980, BASF began shutting down operations at the property. All buildings have been removed, but the foundations and underground infrastructures remain. A 6 to 12-inch clay soil layer was spread over much of the Site to grade the surface.

Several studies were undertaken by government agencies in conjunction with BASF to characterize the Site's environmental conditions. In 1985, BASF installed a system to prevent ground water from leaving the property. BASF will continue to operate and maintain the system at least until the year 2001.

In 1988, officials from the City of Wyandotte and BASF representatives discussed the future use of the Site. BASF and the City agreed that an additional study of the Site was needed after the buildings had been removed and the clay soil layer added.

The purpose of this investigation was to gather quantitative data necessary to develop environmentally sound land use options. The specific objectives of this investigation were to:

- Characterize current soil and ground water conditions on site;
- Define the vertical and lateral extent of compounds in soils (0 to 20-foot depth);
- Gather the quantitative information needed to perform a risk assessment; and
- Assess land use potential and evaluate alternative land uses.

To accomplish these objectives, Environmental Resources Management, Inc. (ERM) designed and implemented a field program that included both qualitative and quantitative investigative methods, including soil gas survey, mobile analytical field screening, soil and ground water sampling, and review of existing data. The study was

divided into two field investigative phases; the first phase consisted of qualitative screening and the second consisted of quantitative analysis. This phased approach allowed for flexibility of data collection, providing both a wider range of choice as well as a basis for comparative judgment. The quantitative data was compiled and used in the risk assessment. The findings of the study were used to arrive at land use alternatives.

This report presents the data collected during this investigation and summarizes the risk assessment conducted using that data. Details of the approach and the results are presented in subsequent sections and appendices.

SECTION 2
INVESTIGATION

2.1 Approach

The investigative scope for this Site consisted of gathering historical information, performing specific field investigations, and carrying out the analyses necessary to address the project objectives. A sequence of steps was employed to characterize the Site. The initial steps consisted of a comprehensive review and evaluation of the available data, a soil gas survey, and other field screening techniques. Based on the results of these activities, a strategy was developed to collect quantitative analytical data for use in the risk assessment.

A search was performed to obtain information pertaining to the Site conditions. Sources of data included the Michigan Department of Natural Resources (MDNR), the U.S. Geological Survey, the Soil Conservation Service, the City of Wyandotte, historical photographs, aerial photographs, and published and unpublished studies of area soils, geology, surface waters and ground water. In addition, a comprehensive review and evaluation of the data available in BASF project files was conducted.

All information gathered was reviewed to identify deficiencies in the data base in preparation for a risk assessment, and to characterize and quantify (to the extent possible) the type and distribution of various substances present on site. The file search also aided in the identification of past Site activities and former land uses which may have had an impact on the Site. The information was used to determine sampling locations and appropriate analytical analyses for the quantitative data component of the investigation.

A qualitative screening was performed to identify potential environmental liabilities early in the investigative process and to aid in focusing the quantitative data collection efforts. The qualitative screening consisted of a visual site inspection, which was conducted by experienced field personnel who searched for surficial indications of concern. In addition to the visual inspection, soil gas vapors were analyzed in the field for volatile organics.

The soil gas survey was conducted using a field gas chromatograph (GC) to better determine the presence of volatile organic compounds (VOCs) currently existing at the Site and to assist in the determination

of quantitative sample locations. A general site grid was established to systematically canvas the entire Site.

An additional qualitative screening technique was employed at the Site to address identified data gaps and supplement earlier data. These data gaps included soil gas survey anomalies and historical areas of interest. A field screening analytical unit was mobilized for on-site screening of volatiles, semi-volatiles, metals and polychlorinated biphenyls (PCBs). The data gathered from the field screening unit was also used to further refine locations for the quantitative investigation efforts.

Quantitative data activities included a shallow soil investigation, a deep soil boring investigation, and ground water sampling. The purpose of the sampling and analysis was to characterize the subsurface conditions and provide input to the risk assessment

2.2 Review of Site Conditions

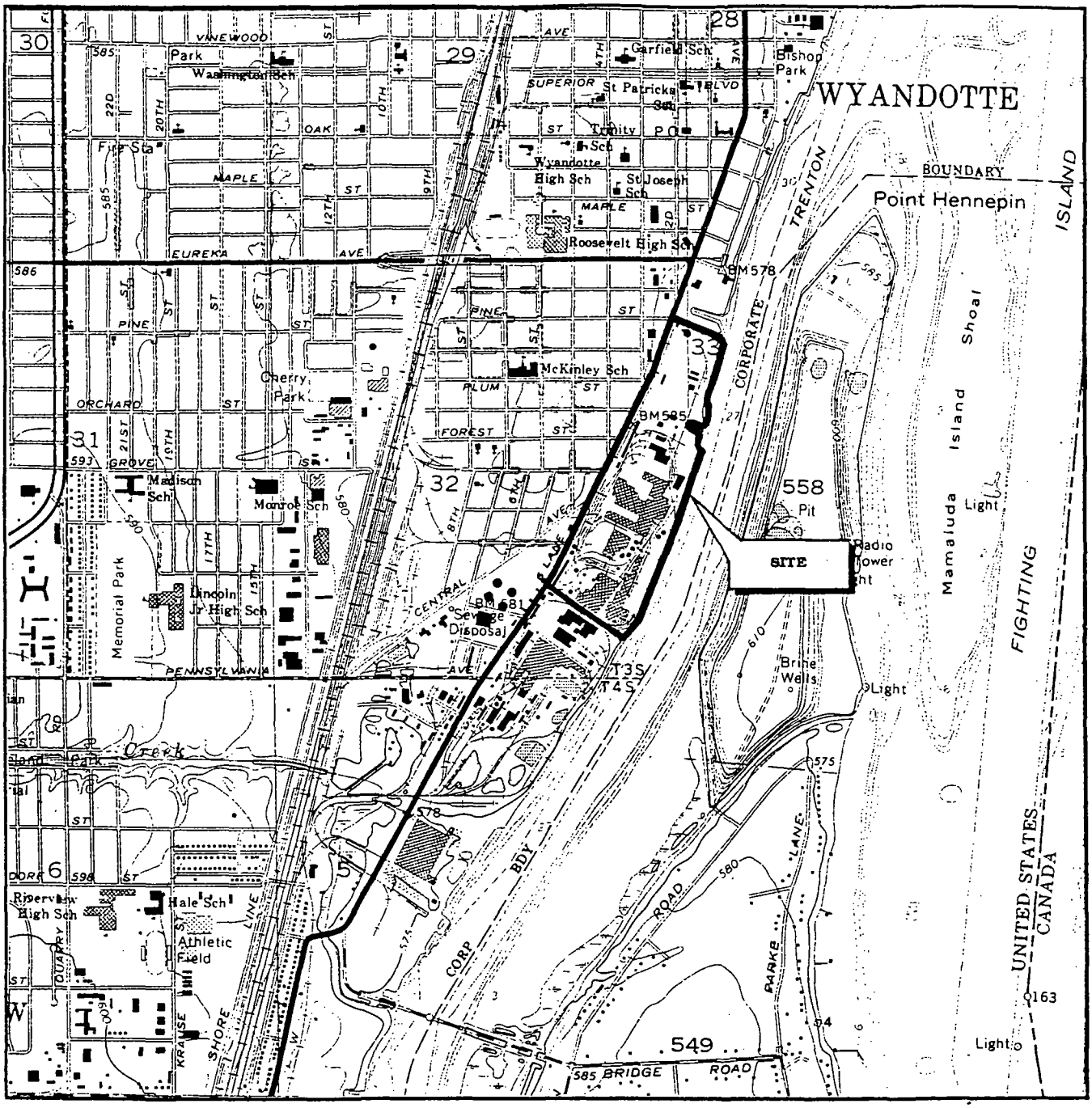
2.2.1 Site Location

The BASF Corporation South Works facility is located within the southern portion of the City of Wyandotte, Michigan, one of Detroit's "Downriver Suburbs" situated about 10 miles south of Detroit's Renaissance Center Area (Figure 2-1). The Site is located adjacent to the west bank of the Detroit River, and extends west from the river to Biddle Avenue and south from Pine Street to Wye Street.

The Site consists of approximately 84 acres. Sections of the Site have different industrial use histories encompassing several owners and multiple business activities. At one time or another each area of the Site was covered with buildings, roadways, parking lots or docks (Figure 2-2). Manufacturing operations by BASF have been discontinued and most of the aboveground structures (manufacturing buildings) have been removed from the Site. However, most of the concrete at or below grade and most of the Site roadways remain.

2.2.2 Site History

Various manufacturing and processing operations have taken place at the Site since 1895, first under the name of Michigan Alkali, then as Wyandotte Chemical, and finally as BASF. Prior to closure of the South Works facility in 1980, a wide variety of operations took place on site including organic and inorganic processing as well as steelmaking, salt mining and shipbuilding, among others. The most important chemical operations included the manufacture of sodium carbonate and



Source: Wyandotte, Mich.-Ont. 7-1/2' topographic quadrangle map (1967-Photorevised 1981).

Figure 2-1
Site Location Map
BASF Corporation - South Works
Wyandotte, Michigan

N

SCALE 1:24 000

1 0 1 MILE

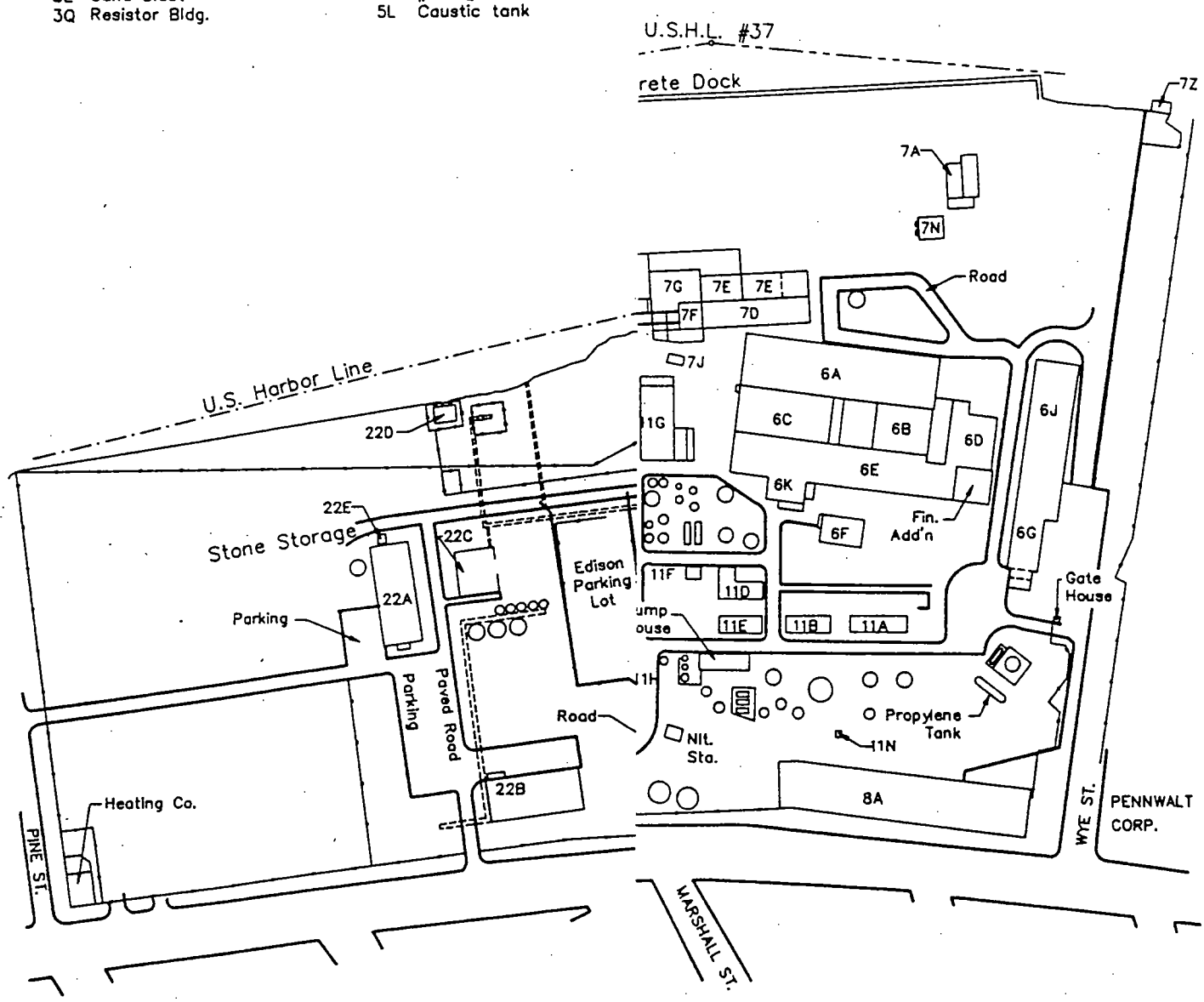
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

Figure 2-2
Base Map
SF Corporation - South Works
Wyandotte, Michigan

LEGEND

1A	Stone Screening	4A	Causticizer / Filter Bldg.
1B	Coke Storage	4B	Salts Extraction and Brir
1C	Stone Bins	4C	STGE
1F	Pump House	4D	Store Room
1G	Lime House	4F	Evaporators
2A	Water Purifier	4G	North Pot Bldg.
2B	Boiler House	4H	South Pot Bldg.
2D	Turbine Room	4J	Caustic Shipping
2E	Flash Tank Bldg.	4M	Locker Room
2F	Compressor Engine Room	4N	Locker Facility
2J	Storage	4R	Construction Office
3A	Process Bldg.	4S	Drum Plant
3C	Stock House	4T	S.W.P.M.
3D	Dissolver	5A	Emergency Cl_2
3E	Carbon Shop	5B	Liquifier
3G	Garrage	5C	#2 Cl_2 Drying
3H	Loco. House	5D	Rectifiers
3L	Sand Blast	5F	#2 Cl_2 Cell Room
3Q	Resistor Bldg.	5L	Caustic tank



Note: Drawing Shows Site Prior to Demolition

400 600 800

Feet

WO#	Drawn by / Date: T. Stevens 2-11-90	Che
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bicarbonate, caustic and chlorine (via both diaphragm and mercury cells), sodium hypochlorite, propylene, ethylene glycol, and ethylene oxide, metallurgical lime, dry ice, and other support functions such as brine purification, and steam and power operations.

A search was performed of historical records provided by BASF and the City of Wyandotte, and the various owners and businesses, along with their approximate locations on the property, are summarized in Table 2-1 and described in Appendix A. Figure 2-3 identifies these locations by section.

Several studies were undertaken by government agencies in conjunction with BASF to characterize the Site's environmental condition. According to records available to ERM, the first remedial activity at the South Works Site occurred in 1970. In 1985, BASF installed a system to prevent ground water from leaving the property (Figure 2-4). BASF will continue to operate and maintain the system until at least the year 2001. A brief synopsis of the Site remediation history is summarized in Table 2-2 and described in Appendix B.

2.2.3 Geologic Setting

Regional Geology and Hydrogeology

The BASF South Works Site is located in southeastern Michigan within the City of Wyandotte, a suburb of Detroit. This area is part of the Michigan Basin portion of the Central Lowlands physiographic province of the United States. The surficial geology in the Wyandotte area consists of glacial and post-glacial deposits of lacustrine clays and silts, indicating that the area was previously inundated by ancestral Lake Erie. These surficial deposits are reported to be approximately 40 to 70 feet thick. In some locations, fluvial sands, soft clays and organic material (peat and/or organic clay) may overlie the lacustrine clay. The lacustrine clay deposits are underlain by the bedrock deposits of the Middle Devonian-age Detroit River Group, consisting primarily of dolomite.

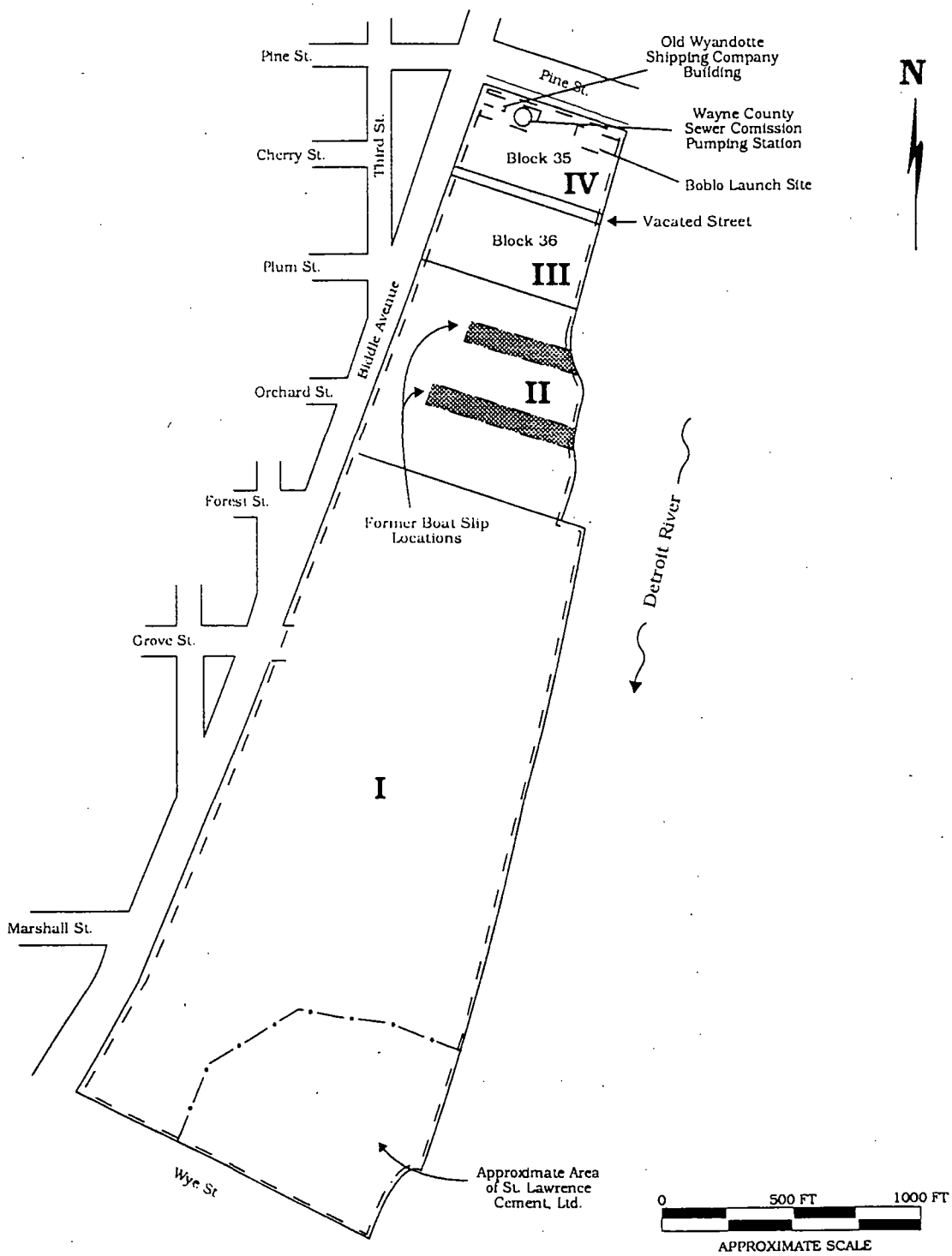
Ground water is commonly present in the more permeable portions of the glacial materials (fluvial sands and/or peats) overlying the lacustrine clay layer. Typically, such water-yielding zones in this area do not contain sufficient quantities of water to provide for domestic water supply. Ground water is also present in the dolomite bedrock, but is reported to contain large concentrations of natural sulfide, rendering it unusable as a source of potable water supply (as determined by both the MDNR and the Wayne County Health Department). All industries, businesses and private residences in the

Table 2-1
Summary of Ownership History
BASF Corporation - South Works Site
Wyandotte, Michigan

Property Location (see Figure 2-3)	Ownership/Property Activity	Approximate Time Frame
Section I	J.B. Ford / Michigan Alkali Company	1895
	Wyandotte Chemical Corporation	1942
	BASF	1971 - Present
	St. Lawence Cement (Leasee)	1971 - 1988
Section II	John & Eliza Biddle	mid-1800's
	Eureka Iron Works	1868
	Eber Ward Shipyards	1873
	Detroit Dry Dock Company	1880
	Detroit Shipbuilding Company	1899
	Various Private Owners	1927-1942
	E.I. duPont / TCE Manufacturing	1942
	Wyandotte Chemical	1961
	BASF	1971 - Present
Section III (Block 36)	John & Eliza Biddle	mid-1800's
	Eureka Iron Company	1868
	Wyandotte Silver Smelting & Refining Co.	1871
Section III (Northern Portion)	Various Private Owners	1886-1897
	Joy Morton & Co. / salt processing	1897-1914
	National Salt Company	
	Port Huron Salt Company	
	Morton Salt Company	
	Detroit Shipbuilding Company	1916
	Various Real Estate Companies	1927-1961
	Wyandotte Chemical Corporation	1961
	BASF	1971 - Present
Section III (Southern Portion)	Detroit Dry Dock Company	1882
	Detroit Shipbuilding Company	1899
	Various Real Estate Companies	1927-1941
	E.I. duPont / TCE Manufacturing	1942
	Wyandotte Chemical Corporation	1961
	BASF	1971 - Present
Section IV (Block 35)	John & Eliza Biddle	mid 1880's
	Eureka Iron Works	1870
	Wyandotte Agricultural Works / (Farm Equipment Manufacturing)	1871
	Various Owners	1875-1882
	Penninsular Stove Company	1882 (6 mo.)
	William Robertson & Sumner Shelley / (Hoop & Stove Manufacturing)	1882
	Joy Morton & Co. / salt processing	1897
	City of Wyandotte	1927
	Wyandotte Chemical Corporation	1941
	BASF	1971- Present
NE Corner Section IV	BOBLO Co. / boat launch	1980's
NW Corner Section IV	Wayne Co. Sewer Comission / Pump Station	1978 - Present
Section IV Building (NW Portion)	Wyandotte Shipping Co. / office building	late 1890's
	Wyandotte Jail House	1900 - 1980's
	Emergency Vehicle Storage	
	Lounge	
	Jim Rademacher / office space (Minnesota Title Company)	Present

Table 2-2
Summary of Remediation History
BASF Corporation - South Works Site
Wyandotte, Michigan

Date of Action	Remedial Action Taken
Apr-70	Michigan Attorney General shuts down the mercury cell chlorine-caustic soda plant using a temporary restraining order to stop the discharge of Wyandotte Chemical Co. effluent directly into the Detroit River. The company begins using a temporary recycling system by rerouting effluent through a settling basin, across the Detroit River via pipeline to the Grosse Ile salt wells, and into the brine source cavity.
1975-1980	Spill incidents include a spill of sodium hydroxide, sodium hypochlorite, and liquor from the chlorine disposal system in 1978 and a spill of hydralic fluid in 1979. In addition, 4,000 gallons of a calcium/sodium chloride solution leaked during 1979. Most spilled or leaked compounds flowed directly into the sewer system and subsequently into the Detroit River, although some spills were contained in treatment ponds. Spills were cleaned up promptly, the proper regulatory agencies were notified, and steps were taken to minimize the potential for future spills.
Jun-81	Michigan Department of Natural Resources (MDNR) and U.S. Environmental Protection Agency (USEPA) conduct a joint field investigation for the South Works site which resulted in the Attorney General of Michigan claiming that BASF had practiced "unlawful disposal of hazardous waste" and demanded compensation for damages.
Nov-83	BASF retains S.S. Papadopulos & Associates to conduct a hydrogeological study of the South Work site. Papadopulos drills 26 observation wells and monitors them weekly for ground water elevations in order to determine groundwater flow direction. In addition, hydraulic conductivity tests are performed.
Aug-84	S.S. Papadopulos & Associates submits a report to BASF describing the shallow geology at South Works site and determines the ground water flow rate and direction.
Dec-84	BASF submits a plan to the MDNR and the Attorney General which calls for sampling of 19 of the existing monitor wells and the installation and monitoring of five new wells by the waterfront.
Jan-85	Analytical results from water samples collected from the monitor wells at BASF South Works site show detectable concentrations of several organic parameters in most of the monitor wells.
Nov-85	The U.S. District Court issues a Consent Decree requiring the remediation of four specific areas of the BASF South Works site. Locations of the areas are shown in Figure 2-4.
Sep-86	An amendment to the Consent Decree is issued which details a new remedial action plan for Area A. Construction of the remedial system for all four areas begins shortly thereafter.
Dec-86	Remediation systems for all four areas are completed and operational. The remedial systems continue to operate by removing affected groundwater from the subsurface and discharging it into the City of Wyandotte sanitary sewer system.



KEY

Fence

Approximate extent of St. Lawrence Cement, Ltd.

Figure 2-3
Property Location Map
BASF Corporation - South Works
Wyandotte, Michigan

WO#	Drawn by/Date: M. Stewart/12-4-90	Checked by/Date: S. Pelowski/12-5-90
160-22-00-01	Revised by/Date:	Checked by/Date:

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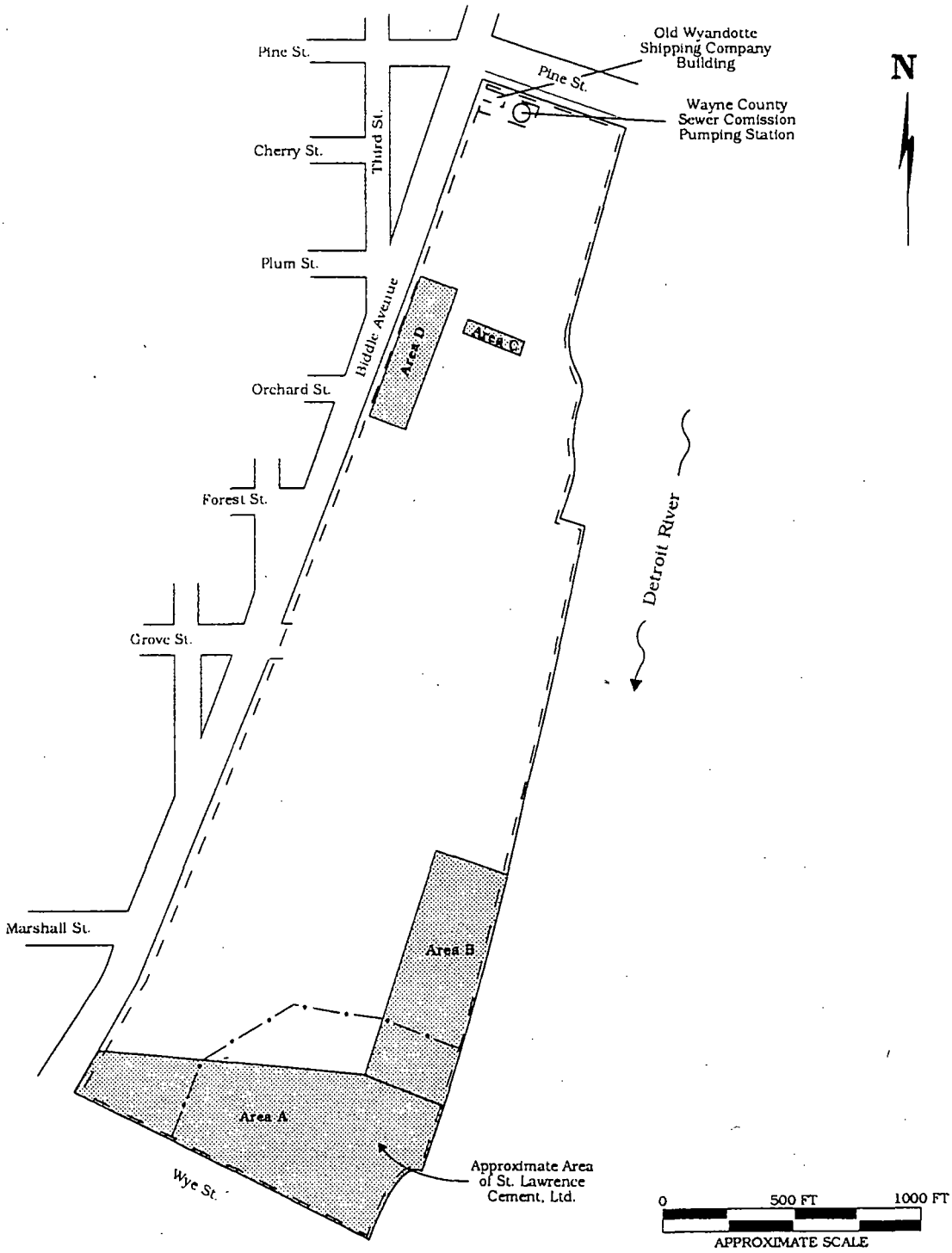

KEY

Fence

Approximate extent of St. Lawrence Cement, Ltd.

Area requiring remediation as defined in Consent Decree (remedial systems currently in operation).

Figure 2-4
Remediation Area as Defined By Consent Decree
BASF Corporation - South Works
Wyandotte, Michigan

WO#	Drawn by/Date: M. Stewart/12-4-90	Checked by/Date: S. Pelowski/12-5-90
160-22-00-01	Revised by/Date:	Checked by/Date:

Source: S.S. Papadopulos & Associates, Inc., Rockville, Maryland, 7 Nov. 85

ERM

area obtain water from the City of Wyandotte which supplies water for its customers from an intake in Lake St. Clair.

Local Geology and Hydrogeology

The eastern one-half to two-thirds of the South Works Site area consists of reclaimed river bottom and marsh land composed of fill materials of varying composition. This fill material overlies naturally deposited lacustrine clays. Previous exploratory borings at the Site indicate that throughout the Site area not covered by concrete (no borings were drilled through any concrete foundations or roadways), at least 3 feet of fill material is present. Near the river, the fill thickness reaches a depth of approximately 25 feet. The fill material occupies the entire length of the Site and is present as a wedge-shaped unit, increasing in thickness eastward from Biddle Avenue to the river. Small units of fluvial sands, peat deposits, and organic clays were also found to occur in many places across the Site, below the fill layer and above the lake clays. These units were primarily present in the western and central portions of the Site and reportedly do not extend to the river (S.S. Papadopulos & Associates, Inc. - Papadopulos). Topographic relief across the Site is generally less than five feet.

The surficial materials, consisting of the fill, the fluvial sand lenses and the peat deposits, comprise the uppermost hydrogeologic system at the Site. Ground water flow in this water-bearing zone is reported to be generally to the east across the Site (towards the Detroit River), although localized flow to the north and south appears to be present in several areas, primarily in the central and north-central portions of the Site. The composition and thickness of this saturated unit is highly variable across the Site, depending upon the relative quantity and thickness of the individual members of the unit (the fill, sand lenses, and peat deposits). Hydraulic conductivity (slug) tests performed by Papadopulos on 30 of the monitor wells and piezometers (small-diameter wells used for determining ground water elevation) installed at the Site indicated a range in transmissivity of the uppermost water-yielding unit from 27 to 4,200 gallons per day per foot (gpd/ft).

The glacial lake clay unit underlying this shallow water-bearing zone has low permeability with respect to the saturated zone described above, and effectively acts as an aquiclude, or hydraulic barrier, separating ground water in the surficial materials from the ground water in the underlying dolomite bedrock. Uniform differences in the water levels of surficial wells compared to the water levels of bedrock wells support the assumption that the clay is acting as an aquiclude

and indicate that there appears to be minimal hydrologic communication between the two water-yielding units.

During the course of ERM's Site investigation, additional borings were drilled at the South Works Site. Field methodology details concerning these borings are presented in Appendix C. Field qualitative headspace results are presented in Table 2-3. Visual descriptions of the encountered subsurface materials were made by an ERM hydrogeologist and a geologic log was developed for each boring. Copies of the geologic logs are included in Appendix D. However, it was noted that the materials encountered during boring advancement were consistent with the descriptions made by others (Papadopulos) during previous work at the Site.

During the ERM investigation, ground water was encountered at depths ranging from approximately 3 to 8 feet below ground surface. The lacustrine clay unit underlying the fill was also present at each of the new boring locations at depths ranging from 6 to 20 feet below ground surface.

2.3 Qualitative Investigation

2.3.1 Soil Gas Survey

A soil gas survey was conducted at the South Works Site to better determine the presence of volatile organics currently existing at the Site and to assist in the determination of monitor well and soil sampling locations. A soil gas survey using a field gas chromatograph (GC) was determined to be the most effective method to obtain the desired information. In addition to the field gas chromatograph, a Jerome 411 mercury meter was used to obtain total volatile mercury vapor concentrations. A synopsis of the qualitative soil gas survey portion of the investigation is briefly presented below. Specific details of the methodology are presented in Appendix C.

A general site grid system was established. The grid system was established as a means to systematically canvas the entire Site. Survey points were located on 200-foot centers. Eighty-five general Site grid points were required to cover the entire South Works Site using these dimensions (Figure 2-5). Results of the soil gas survey are presented in Table 2-4.

The soil gas samples were qualitatively field screened for VOCs (including hydrocarbons) using the field GC. Compound-specific response factors in the field GC are not always indicative of the

Table 2-3
Field Headspace Screening Results
BASF Corporation - South Works
Wyandotte, Michigan

Boring/Well No.	Sample I.D.	Sample Depth (ft)	Headspace OVA Reading (ppm)	Soil Type
	S1	0 - 2	0.4	Fill
	S2	2 - 4	1.5	Fill
	S3**	4 - 6	1.6	Fill
MW-1	S4	6 - 8	N/A	N/A
	S5	8 - 10	0.4	Fill
	S6**	10 - 12	130	Sandy clay
	S7	12 - 14.2	N/A	Sandy clay
	S1	0 - 2	7	Topsoil/Fill
	S2**	2 - 4	115	Fill
MW-2	S3	4 - 6	>1000	Fill
	S4**	6 - 7	770	Sand Fill
	S5	7 - 9	270	Sandy Clay
	S6	9 - 10.3	N/A	Sandy Clay
	S1	0 - 2	0.3	Topsoil/Fill
	S2	2 - 4	5	S. Clay Fill
	S3**	4 - 6	300	Silty Clay
MW-3	S4	6 - 7	310	Silty Clay
	S5	7 - 9	360	Sand Fill
	S6**	9 - 11	180	Sand/Clay
	S7	11 - 12.9	N/A	Clay
	S1	0 - 2	1.1	Fill
	S2	2 - 4	5	Fill
	S3	4 - 6	48	Fill/Clay
	S4**	6 - 8	330	Clay
	S5	8 - 10	130	Clay
MW-4	S6	10 - 12	240	Clay/Sand
	S7	12 - 14	680	Silt
	S8	14 - 16	480	Silty Sand
	S9**	16 - 18	>1000	Silty Sand
	S10	18 - 20	350	Silty Sand
	S11	20 - 22	230	Sand/Clay
	S12	22 - 24	130	Clay
	S1	0 - 2	0.6	Fill
MW-5	S2	2 - 4	N/A	Fill
	S3**	4 - 6	33	S. Clay Fill
	S4	6 - 8	19	Sand/Clay
	S1	0 - 0.5	18	Topsoil
	S2**	2 - 4	800	Sand Fill
	S3	4 - 6	600	Sand
MW-6	S4	6 - 8	>1000	Sand
	S5	8 - 10	>1000	Sand/Clay
	S6**	10 - 12	>1000	Clay
	S7	12 - 13	>1000	Clay
	S1	0 - 2	0.5	Fill
	S2**	2 - 4	7	Clay/Sand Fill
	S3	4 - 6	450	Sand Fill
MW-7	S4	6 - 8	>1000	Sand
	S5**	8 - 10	>1000	Sand/Clay
	S6	10 - 11	140	Clay
	S7	11 - 12.1	N/A	Clay

NOTES:

1. OVA Headspace Readings in parts per million (ppm) methane equivalent
2. N/A = No data obtained for this sample
3. ND = Non-detectable
4. * = Submitted to ERM-FAST™ for field Analysis
5. ** = Submitted to GSAI Analytical laboratory for Analysis

Table 2-3
Field Headspace Screening Results
BASF Corporation - South Works
Wyandotte, Michigan

Boring/Well No.	Sample I.D.	Sample Depth (ft)	Headspace OVA Reading (ppm)	Soil Type
DB-1	S1*	2 - 4	6.1	Fill
	S2	4.5 - 6.5	ND	No recovery
	S3*	7 - 9	2.2	Clay
	S4*	9.5 - 11.5	ND	Clay
	S5*	12 - 14	0.3	Clay
	S6*	14 - 15	ND	Clay
DB-2	S1*	0 - 2	4.2	Fill
	S2*	3 - 5	6.1	Sand
	S3*	5.5 - 7.5	6.0	Clay
	S4**	8 - 10	59.0	Clay
	S5*	10.5 - 12.5	237.0	Clay
	S6	13 - 15	N/A	No recovery
DB-3	S1*	0 - 2	0.8	Fill
	S2	3 - 5	30.6	Fill
	S3	5.5 - 7.5	125.3	Fill
	S4*	8 - 9	141.0	Sand
	S5	10.5 - 12.5	11.0	Clay
	S6*	13 - 15	1.5	Clay
DB-4	S1**	0 - 2	ND	Fill
	S2	3 - 4.5	7.6	Clay/Sand
	S3	5.5 - 7.5	ND	Dlay
	S4	8 - 10	ND	Sand
	S5*	10.5 - 12.5	19.5	Clay
	S6*	13 - 15	6.9	Clay
DB-5	S1*	2 - 4	ND	Fill
	S2	3 - 5	ND	Fill
	S3	5.5 - 7	2.2	Clay/Sand
	S4*	8 - 10	3.7	Sand
	S5	10.5 - 12.5	4.2	Sand
	S6*	13 - 15	4.1	Sand/Clay
DB-6	S1*	0 - 2	ND	Fill
	S2	3 - 5	2.2	Sand
	S3	5.5 - 7.5	2.4	Sand
	S4	8 - 8.5	4.3	Sand/Clay
	S5*	10.5 - 12.5	4.4	Clay
	S6*	13 - 15	4.3	Clay
DB-7	S1	0 - 2	ND	Fill
	S2*	3 - 5	ND	Fill
	S3	5.5 - 7.5	2.3	Fill
	S4*	8 - 10	8.0	Fill
	S5	10.5 - 12.5	6.0	Sand
	S6*	13 - 15	2.2	Clay

NOTES:

1. OVA Headspace Readings in parts per million (ppm) methane equivalent
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Table 2-3
Field Headspace Screening Results
BASF Corporation - South Works
Wyandotte, Michigan

Boring/Well No.	Sample I.D.	Sample Depth (ft)	Headspace OVA Reading (ppm)	Soil Type
DB-8	S1*	0 - 2	2.2	Fill
	S2*	3 - 5	1.0	Fill
	S3*	5.5 - 7.5	2.2	Fill
	S4*	8 - 10	N/A	Fill
	S5**	10.5 - 12.5	84.4	Fill
DB-9	S1*	0 - 2	1.2	Fill
	S2*	3 - 5	4.1	Fill
	S3*	5.5 - 7.5	5.2	Fill
	S4	8 - 8.5	N/A	No sample
DB-10	S1*	0 - 2	ND	Fill
	S2	3 - 5	ND	Fill
	S3*	5.5 - 7.5	1.2	Fill
	S4	8 - 10	ND	Fill
	S5	10.5 - 12.5	N/A	No sample
	S6*	13 - 15	ND	Sand
DB-11	S1*	0 - 2	ND	Fill
	S2*	3 - 5	ND	Fill
	S3*	5.5 - 7.5	4.0	Sand
	S4	8 - 10	3.0	Sand/Clay
	S5	10.5 - 10.8	1.2	Clay
DB-12	S1*	0 - 2	ND	Fill
	S2*	3 - 5	8.4	Fill
	S3*	5.5 - 7.5	2.0	Fill
	S4*	8 - 10	N/A	Fill
DB-13	S1*	0 - 2	2.2	Fill
	S2	3 - 5	2.2	Fill
	S3**	5.5 - 7.5	51.4	Fill
	S4*	8 - 10	143.0	Sand
	S5*	10.5 - 12.5	134.0	Clay
	S6*	13 - 15	14.2	Clay
DB-14	S1*	0 - 2	ND	Fill
	S2	3 - 5	212.0	Fill
	S3*	5.5 - 7.5	241.0	Fill
	S4	8 - 10	112.0	Clay
	S5*	10.5 - 12.5	59.2	Clay
DB-15	S1*	0 - 2	ND	Fill
	S2*	3 - 5	128.0	Sand
	S3*	5.5 - 7.5	111.2	Clay
	S4	8 - 10	4.0	Clay
	S5*	10.5 - 12.5	75.2	Clay
	S6*	13 - 15	131.1	Clay

NOTES:
1. OVA Headspace Readings in parts per million (ppm) methane equivalent
2. N/A = No data obtained for this sample
3. ND = Non-detectable
4. * = Submitted to ERM-FAST™ for field Analysis
5. ** = Submitted to GSAI Analytical laboratory for Analysis

Table 2-3
Field Headspace Screening Results
BASF Corporation - South Works
Wyandotte, Michigan

Boring/Well No.	Sample I.D.	Sample Depth (ft).	Headspace OVA Reading (ppm)	Soil Type
DB-16	S1*	0 - 2	ND	Clay
	S2	3 - 5	ND	Sand
	S3*	5.5 - 7.5	ND	Sand
	S4	8 - 10	ND	Clay
	S5	10.5 - 12.5	ND	Clay
	S6*	13 - 15	ND	Clay
DB-17	S1*	0 - 2	ND	Clay
	S2	3 - 5	4.2	Sand
	S3	5.5 - 7.5	N/A	No sample
	S4	8 - 10	210.0	Sand
	S5	10.5 - 12.5	134.0	Clay
	S6	13 - 15	128.0	Clay
DB-18	S1*	0 - 2	1.4	Fill
	S2	3 - 5	ND	Sand
	S3	5.5 - 7.5	ND	Sand
	S4*	8 - 10	ND	Sand
	S5	10.5 - 12.5	2.0	Sand
	S6*	13 - 15	5.0	Clay
DB-19	S1	0.0-2.0	65.4	Fill
	S2	3.0-5.0	427	Fill
	S3**	5.5-7.5	58.5	Clay
	S4	8.0-10.0	32.1	Clay
	S5	10.5-12.5	34.7	Clay
	S6	13.0-15.0	50	
DB-20	S1**	0.0-2.0	7.5	Fill
	S2	3.0-5.0	1.9	Fill
	S3	5.5-7.5	N/A	No sample
	S4	8.0-10.0	N/A	No sample
	S5	10.5-12.5	2.5	Clay
	S6	13.0-15.0	0.04	Clay
DB-21	S1	0.0-2.0	1.2	Fill
	S2	3.0-5.0	1.2	No sample
	S3	5.5-7.5	N/A	No sample
	S4**	8.0-10.0	10.3	Sand
	S5	10.5-12.5	6.4	Clay
	S6	13.0-15.0	3.2	Clay
DB-22	S1	0.0-2.0	4	Fill
	S2	3.0-5.0	ND	Fill
	S3**	5.5-7.5	3.8	Fill
	S4	8.0-10.0	1.4	Fill
	S5	10.5-12.5	ND	Clay
	S6	13.0-15.0	N/A	No sample

NOTES:

1. OVA Headspace Readings in parts per million (ppm) methane equivalent
2. N/A = No data obtained for this sample
3. ND = Non-detectable
4. * = Submitted to ERM-FAST™ for field Analysis
5. ** = Submitted to GSAI Analytical laboratory for Analysis

Table 2-3
Field Headspace Screening Results
BASF Corporation - South Works
Wyandotte, Michigan

Boring/Well No.	Sample I.D.	Sample Depth (ft).	Headspace TIP II Reading (ppm)	Soil Type
	S1	0.0-2.0	1.3	Fill
	S2	3.0-5.0	3	Fill
DB-23	S3	5.5-7.5	7.6	Sand
	S4**	8.0-10.0	10	Clay
	S5	10.5-12.5	4.6	Clay
	S6	13.0-15.0	2.5	Clay
	S1	0.0-2.0	0.6	Fill
	S2**	3.0-5.0	4	Fill
DB-24	S3	5.5-7.5	1.5	Clay
	S4	8.0-10.0	1.4	Clay
	S5	10.5-12.5	1.4	Clay
	S6	13.0-15.0	1.6	Clay
	S1	0.0-2.0	1.7	Fill
	S2	3.0-5.0	18.1	Fill
DB-25	S3	5.5-7.5	40.1	Clay
	S4	8.0-10.0	45.7	Clay
	S5	10.5-12.5	53	Clay
	S6**	13.0-15.0	65.4	Clay
	S1	0.0-2.0	9	Clay
	S2	3.0-5.0	18	Clay
DB-26	S3*	5.5-7.5	5	Clay
	S4	8.0-10.0	3.4	Clay
	S5	10.5-12.5	2	Clay
	S1	0.0-2.0	N/A	No sample
	S2	3.0-5.0	3.7	Fill
DB-27	S3	5.5-7.5	4.7	Fill
	S4	8.0-10.0	N/A	No sample
	S5**	11.0-13.0	8	Clay
	S6	13.0-15.0	7.3	Clay
	S1	0.0-2.0	10	Fill
	S2	3.0-5.0	7	Fill
DB-28	S3	6.0-8.0	12.5	Fill
	S4	8.5-10.5	2.5	Fill
	S5**	12.0-14.0	36.4	Clay
	S1	0.0-2.0	7.1	Fill
	S2**	3.0-5.0	24	Fill
	S3	5.5-7.5	12.8	Sand
DB-29	S4	8.0-10.0	9	Sand
	S5	10.5-12.5	6.8	Sand
	S6	13.0-15.0	5.8	Clay
	S1	0.0-2.0	6.4	Fill
	S2	3.0-5.0	5.6	Fill
DB-30	S3	5.5-7.5	2.8	Fill
	S4	8.0-10.0	10.8	Sand
	S5**	10.5-12.5	11.2	Sand
	S6	13.0-15.0	5.6	Sand

NOTES:
1. TIP II Headspace Readings in parts per million (ppm) isobutylene equivalent
2. N/A = No data obtained for this sample
3. ND = Non-detectable
4. * = Submitted to ERM-FAST™ for field Analysis
5. ** = Submitted to GSAI Analytical laboratory for Analysis

Table 2-3
Field Headspace Screening Results
BASF Corporation - South Works
Wyandotte, Michigan

Boring/Well No.	Sample I.D.	Sample Depth (ft).	Headspace TIP II Reading (ppm)	Soil Type
SSB-47	S1**	2.0-3.0	25.4	Fill
SSB-48	S1**	2.0-3.0	ND	Fill
SSB-49	S1**	2.0-3.0	ND	Fill
SSB-50	S1**	2.0-3.0	0.9	Fill
SSB-51	S1**	2.0-3.0	ND	Fill
SSB-52	S1**	2.0-3.0	ND	Fill
SSB-53	S1**	2.0-3.0	ND	Fill
SSB-54	S1**	2.0-3.0	ND	Fill
SSB-55	S1**	2.0-3.0	1.8	Fill
SSB-56	S1**	2.0-3.0	111.5	Fill
SSB-57	S1**	2.0-3.0	8.7	Fill
SSB-58	S1**	2.0-3.0	148	Fill
SSB-59	S1**	2.0-3.0	ND	Fill
SSB-60	S1**	2.0-3.0	ND	Fill
SSB-61	S1**	2.0-3.0	ND	Fill
SSB-62	S1**	2.0-3.0	ND	Fill
SSB-63	S1**	2.0-3.0	2.1	Fill
SSB-64	S1**	2.0-3.0	28.4	Fill
SSB-65	S1**	2.0-3.0	1.1	Fill

NOTES:
1. TIP II Headspace Readings in parts per million (ppm) isobutylene equivalent
2. N/A = No data obtained for this sample
3. ND = Non-detectable
4. * = Submitted to ERM-FAST™ for field Analysis
5. ** = Submitted to GSAI Analytical laboratory for Analysis

Table 2-4
Soil Gas Survey Results
BASF Corporation - South Works
Wyandotte, Michigan

	GAS CHROMATOGRAPH RESULTS (ppb)					OVA RESULTS (ppm)		
SAMPLE I.D.	Vinyl Chloride	1,1- DCE	1,2- DCE	TCE	TOTAL	MERCURY	PEAK	STABLE
A-1	ND	ND	ND	ND	5	ND	11	3
A-2	ND	ND	3	7	23	ND	ND	ND
A-3	3	7	283	2452	3175	ND	80	70
A-4	4	10	6188	22163	27680	ND	640	640
A-5	ND	ND	ND	5	28	ND	ND	ND
A-6	ND	ND	ND	ND	85	ND	ND	ND
A-7	10	ND	23	ND	69	ND	26	7
A-8	18	ND	<1	ND	76	0.007	47	17
A-9	54	42	15	28	1006	ND	215	24
A-10	ND	29	<1	ND	186	ND	115	54
A-11	28	4	ND	2	201	ND	155	17
A-12	<1	ND	ND	ND	20	ND	9	4
A-13	39	22	14	ND	95	ND	100	19
A-14	35	30	57	ND	161	0.003	47	15
A-15	85	10	ND	74	177	ND	100	19
A-16	471	ND	ND	ND	471	ND	280	52
A-17	110	ND	ND	156	294	ND	8	6
A-18	16	ND	ND	77	103	ND	100	8
B-1	ND	ND	ND	ND	ND	ND	ND	ND
B-2	ND	ND	ND	ND	ND	ND	10	3
B-3	<1	5	26	122	153	ND	5	5
B-4	<1	ND	<1	<1	103	ND	100	6
B-5	9	11	<1	29	80	ND	120	15
B-6	3	ND	ND	7	31	ND	20	9
B-7	28	ND	ND	5	180	ND	100	22
B-8	37	ND	ND	<1	230	ND	74	12
B-9	11	ND	ND	<1	23	ND	23	6
B-10	ND	ND	ND	<1	28	ND	40	13
B-11	ND	ND	ND	ND	27	ND	24	10
B-12	ND	ND	ND	ND	ND	ND	2	1
B-13	ND	26	12	ND	186	ND	>1000	16
B-14	<1	ND	ND	ND	12	0.027	4	1
B-14A	48	25	16	4	235	0.551	230	9
B-14B	ND	ND	ND	ND	2	0.001	1	ND
B-14C	287	25	ND	ND	356	0.54	275	10
B-14D	105	20	80	ND	648	0.009	265	9
B-15	3028	121	ND	ND	3711	ND	>1000	11
B-16	5286	4114	303	16439	27979	ND	>1000	600
B-17	285	ND	ND	ND	555	ND	250	16
B-18	74	21	15	22	182	ND	260	12
C-1	ND	ND	ND	ND	ND	ND	ND	ND
C-2	ND	ND	ND	6	6	ND	4	ND
C-3	35	2	358	133	572	ND	50	22
C-4	4	11	487	654	1157	ND	80	80
C-4	30	<1	229	530	933	ND	115	42
C-4	24	ND	190	535	1011	ND	155	68
C-4	38	10	109	264	535	ND	62	33
C-5	11	5	ND	ND	30	ND	100	38
C-6	ND	ND	ND	ND	283	ND	>1000	59
C-6A	69	326	ND	ND	837	NA	430	38
C-6B	43	18	18	ND	174	NA	105	8
C-6C	40	9	7	ND	167	NA	310	14
C-6D	193	14	25	ND	343	NA	86	3

QUALIFIER CODES:

1) 1,2-DCE - Value reported is total of c-1,2 and t-1,2 DCE
   NA - No data available for this sampling point
   ND - none detected
2) Total is sum of all compounds detected by the PID GC
3) ppm in isobutylene equivalents

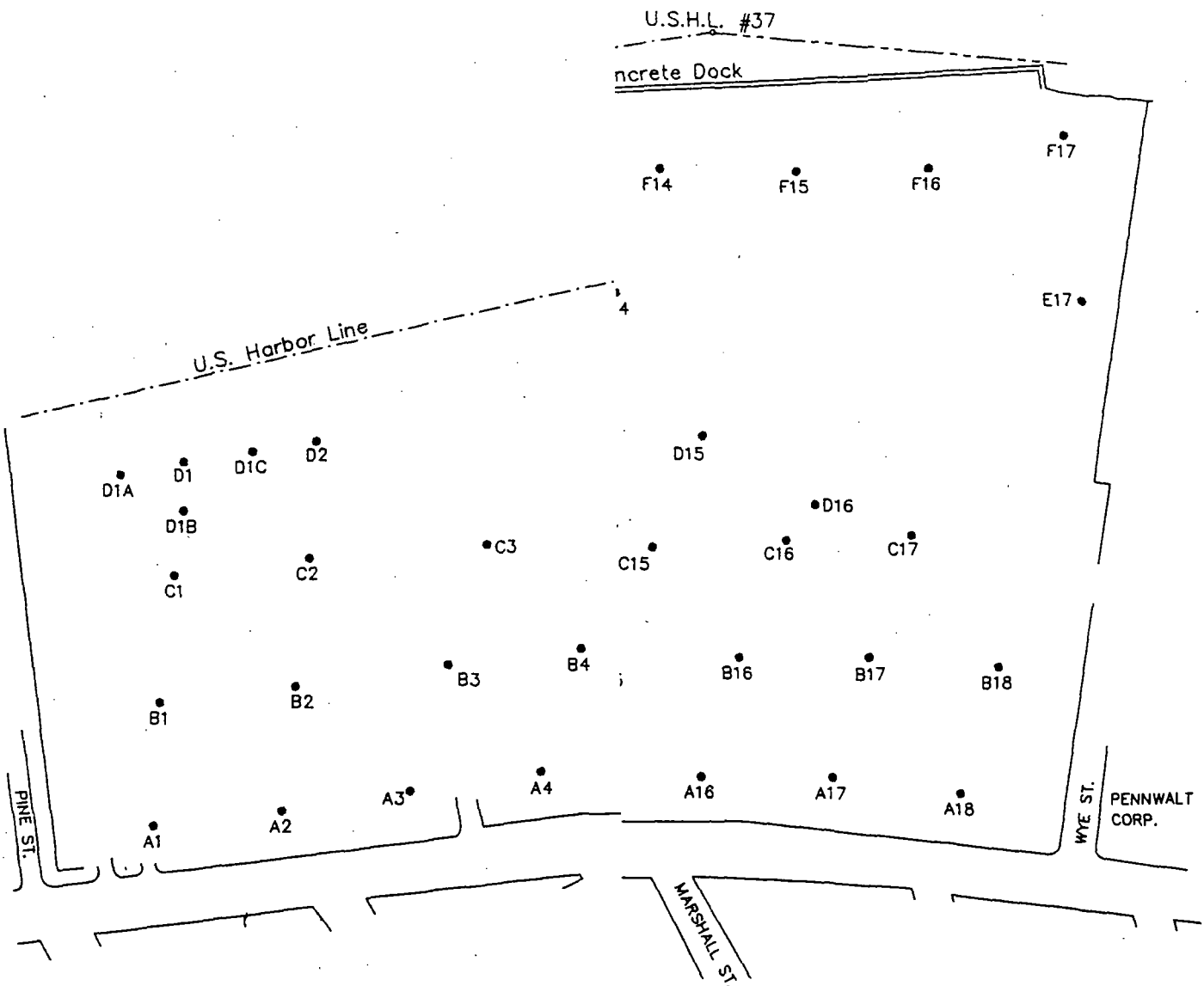
Table 2-4
Soil Gas Survey Results
BASF Corporation - South Works
Wyandotte, Michigan

	GAS CHROMATOGRAPH RESULTS (ppb)					OVA RESULTS (ppm)		
SAMPLE I.D.	Vinyl Chloride	1,1- DCE	1,2 - DCE	TCE	TOTAL	MERCURY	PEAK	STABLE
C-7	ND	ND	3	ND	81	ND	85	40
C-8	5	6	ND	ND	36	ND	ND	ND
C-9	11	6	6	ND	37	ND	ND	ND
C-10	50	40	5	ND	168	ND	ND	ND
C-11	46	16	8	ND	78	NA	ND	ND
C-12	17	9	15	ND	61	NA	ND	ND
C-13	10	ND	40	ND	50	NA	ND	ND
C-14	2	3	5	ND	22	ND	ND	ND
C-15	9260	490	ND	ND	9735	ND	ND	ND
C-16	3513	322	ND	48	9266	ND	ND	ND
C-17	159	13	ND	10	1161	ND	ND	ND
D-1	75	53	77	4	536	ND	300	11
D-1A	14	ND	ND	ND	47	NA	47	3
D-1B	13	ND	ND	ND	46	NA	77	8
D-1C	5	ND	ND	ND	18	NA	100	10
D-2	ND	2	ND	ND	62	ND	300	11
D-4	30	13	12	3	82	ND	13	8
D-5	ND	ND	5	ND	319	ND	370	35
D-6	152	ND	70	6	638	ND	140	30
D-7	94	ND	18	ND	262	ND	ND	ND
D-8	34	ND	8	ND	208	ND	ND	ND
D-9	11	9	3	ND	61	ND	ND	ND
D-10	23	16	11	ND	92	ND	ND	ND
D-11	34	19	12	ND	72	NA	ND	ND
D-12	1	4	9	ND	28	NA	ND	ND
D-13	27	6	ND	ND	224	NA	ND	ND
D-14	297	ND	13	50	360	ND	ND	ND
D-15	ND	ND	ND	ND	864	ND	ND	ND
D-16	19621	ND	ND	NC	19743	ND	ND	ND
E-7	30	ND	15	ND	145	ND	ND	ND
E-8	100	18	18	ND	464	ND	ND	ND
E-9	145	ND	26	ND	527	ND	ND	ND
E-10	ND	ND	ND	ND	ND	ND	ND	ND
E-11	88	15	28	ND	323	0.002	ND	ND
E-12	48	ND	8	ND	185	ND	ND	ND
E-13	23	7	10	ND	45	ND	ND	ND
E-14	ND	20	32	ND	176	ND	ND	ND
E-17	1098	680	340	35	4868	0.001	ND	ND
F-10	51	15	ND	ND	249	ND	ND	ND
F-11	63	25	20	ND	223	ND	ND	ND
F-12	30	23	ND	8	1062	0.017	ND	ND
F-12A	8	ND	ND	ND	133	0.298	195	12
F-12B	50	42	30	57	724	0.012	160	10
F-12C	50	45	15	11	381	0.007	98	16
F-13	50	25	ND	24	449	ND	ND	ND
F-14	30	ND	ND	ND	208	0.009	ND	ND
F-15	39	154	60	98	1626	ND	ND	ND
F-16	6	ND	ND	ND	29	0.007	ND	ND
F-17	30	22	18	ND	139	ND	ND	ND

QUALIFIER CODES:

1) 1,2-DCE - Value reported is total of c-1,2 and t-1,2 DCE
   NA - No data available for this sampling point
   ND - none detected
2) Total is sum of all compounds detected by the PID GC
3) ppm - isobutylene equivalents

Figure 2-5
Soil Gas Sample Location Map
BASF Corporation - South Works
Wyandotte, Michigan



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absence of contamination nor actual soil or ground water conditions. No determination can be made in a field setting as to specific VOC concentrations in soil and groundwater. While the field GC provides only non-quantitative results, it can be used as a reliable field qualitative screening technique.

The soil gas survey results showing total VOC concentrations indicate two primary areas of soil gas anomalies - one in the north end of the Site near sample point A-4 and one in the south end of the Site west of and among the former cement plant structures (B16, C15, C16, C17, D14, D16, D17, and E17). Several additional smaller areas also show elevated concentrations of VOCs (Table 2-4).

The results of the total mercury vapor concentration portion of the soil gas survey indicate two small areas of potential mercury interest. Both are located near the former mercury process or handling areas (B-14 and F-12).

Based on the soil gas survey data, a general trend was observed indicating two primary areas of VOC anomalies, in addition to several smaller areas. Most of these areas were readily associated with previous Site operations and/or structures.

2.3.2 Field Analytical Services Screening

An additional qualitative investigation was conducted at the South Works Site to address gaps in data collected during previous investigations (soil gas anomalies and historical areas of interest) as well as to provide a general canvas of the Site for further quantitative delineation. Soil samples were collected for on-site screening using ERM's mobile field unit (Field Analytical Services Technology - FAST^{SM}). The qualitative on-site analyses included field headspace screening, volatiles, semi-volatiles, metals and PCBs. The field analytical data procedures are described in Appendix C. A summary of the qualitative data generated by ERM-FAST^{SM} unit is presented in Tables 2-3 through 2-6 and Appendix F. The quality assurance report for the ERM-FAST^{SM} data is presented in Appendix H.

Data collected during the field analysis was valuable as a qualitative screening tool but should not be interpreted as indicating the absence of contamination or the actual soil conditions. Specific VOC, semi-volatiles, metal and PCB concentrations cannot be quantified in a field setting for soil samples.

The results of the qualitative on-site screening indicated elevated levels of arsenic, lead or mercury detected in several surface soil

Table 2-5
Summary of Qualitative Field Results - Shallow Soils
BASF Corporation - South Works
Wyandotte, Michigan

Compound (mg/kg)	SSP-1	SSP-2	SSP-3	SSP-4	SSP-5	SSP-6	SSP-7	SSP-8	SSP-9	SSP-10	SSP-10	SSP-11	SSP-12	SSP-13	SSP-14	SSP-15	SSP-16	SSP-16
Priority Pollutant Metals																		
Potassium (%)	2.1	1.3	0.8	0.6	0.6	0.7	0.3	1.2	1.2	0.6	ND	0.6	0.9	1.6	1.1	0.5	1.9	ND
Calcium (%)	9.2	3.4	1.4	6.5	20.1	8.9	9.6	5.4	1.8	4.3	ND	2.5	6.7	5.3	6.8	14.0	9.7	ND
Iron (%)	4.0	2.0	9.9	12.3	5.9	17.6	8.2	6.7	8.9	6.2	ND	29.3	7.1	4.1	3.5	5.5	3.1	ND
Arsenic	13.5	11.4	145.2	23.4	ND	ND	23.8	ND	29.0	21.3	ND	ND	46.1	ND	20.9	48.5	17.6	ND
Lead	47.6	21.2	95.6	2351.3	1016.6	4264.9	844.8	951.4	379.1	257.1	ND	2829.6	329.8	232.2	272.1	392.9	17.9	ND
Mercury	4.6	ND	4.6	ND	ND	42.6	ND	0.1	ND	ND	ND	5.9	8.2	8.2	ND	6.9	ND	ND
Priority Pollutant Volatiles																		
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.39	ND	ND	ND	ND	ND	ND	0.23	ND
Benzene	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	0.07 Q	0.01 R	ND	0.01 R	ND	ND	0.07 Q	0.18	ND	0.09 Q	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	0.02 R	ND	ND	ND	ND	0.76	ND	ND	ND	ND	ND	0.1 Q	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	7.71	3.52	ND	0.1	ND	ND	ND	ND	ND	ND
Dichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	3.46	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	0.08 R	0.1 Q	ND	0.12	ND	ND	ND	ND	ND	ND	0.31	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.76	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	0.19	ND	ND	0.1 Q	3.77	21.28	35.8	0.33	0.68	1.19	0.19	0.75	0.06 Q	1.68	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	1.42	0.02 R	ND	ND	ND	ND	0.07 Q	ND	ND	ND	ND	ND
Priority Pollutant Semi-Volatiles																		
bis(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	0.99	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.08 Q	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.09	1.09
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	2.63	ND	0.41	0.42	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	0.15 Q	0.19	0.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.49	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	1.96	ND	ND	0.49	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	0.13 Q	0.13 Q	ND	ND	2.9	0.08 Q	0.72	0.73	ND	ND	ND	ND	0.23	0.23
Naphthalene	ND	3.69	ND	ND	ND	ND	73.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.48	2.48
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	0.53	ND	ND	ND	3.69	ND	ND	ND	ND	ND
PCBs	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.33	ND

ND indicated analyzed, but not detected
Q: This is a quantitatively questionable result.
R: This is a quantitatively unreliable result.
Concentrations in mg/kg (parts per million equivalent)
Analysis using ERM-FAST™ probe

Table 2-5
Summary of Qualitative Field Results - Shallow Soils
BASF Corporation - South Works
Wyandotte, Michigan

Compound (mg/kg)	SSP-18	SSP-19	SSP-20	SSP-21	SSP-22	SSP-23	SSP-24	SSP-25	SSP-26	SSP-27	SSP-28	SSP-29	SSP-30	SSP-30	SSP-31
Priority Pollutant Metals															
Potassium (%)	0.8	0.9	ND	ND	1.6	0.8	0.4	0.7	0.3	ND	0.5	1.5	0.5	ND	0.1
Calcium (%)	3.1	5.9	24.8	42.9	8.3	10.0	19.0	15.4	17.7	17.3	16.1	4.8	21.1	ND	20.6
Iron (%)	3.4	9.9	2.2	0.6	5.5	2.0	3.1	3.1	3.8	6.2	2.6	2.5	5.7	ND	3.3
Arsenic	85.5	ND	ND	7.1	ND	20.3	5.0	24.8	8.3	78.3	ND	9.1	68.6	ND	ND
Lead	400.8	ND	359.1	60.8	360.2	70.3	316.0	242.4	712.7	312.3	173.5	115.8	119.5	ND	1022.5
Mercury	ND	ND	7.4	ND	9.0	6.0	16.0	ND	23.0	35.7	ND	ND	50.2	ND	336.7
Priority Pollutant Volatiles															
Acetone	0.26	.13 Q	.11 Q	0.41	ND	0.4	.06 Q	0.06 Q	0.04 R	0.17	0.05 Q	0.09 Q	0.05 R	0.004 R	0.05 R
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	0.15	.14 Q	0.26	0.17	.023 R	0.04 R	0.04 R	0.06 Q	0.05 Q	0.05 R	0.02 R	0.02 R	0.03 R
1,2-Dichloroethane	ND	ND	0.16	ND	ND	ND	ND	ND	0.02 R	0.05 R	ND	ND	0.02 R	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	0.74	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	0.04 R	0.49	0.05 Q	0.06 Q	ND	0.05 R	0.01 Q	0.02 R	ND	0.03 R	ND	0.03 R	ND	0.03 R	0.02 R
1,1,1-Trichloroethane	ND	ND	0.04	0.02 R	0.05 R	0.04 R	ND	0.01 R	0.01 R	0.2 R	0.01 R	0.01 R	0.01 R	0.01 R	ND
Trichloroethene	ND	36.34	ND	ND	3.38	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Priority Pollutant Semi-Volatiles															
bis(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02 R	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	0.22	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	1.7 Q	0.73 Q	ND	ND	0.21 Q	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	0.64 Q	4.3 Q	ND	ND	0.08 Q	ND	ND	ND	ND	0.12 Q	0.06 Q	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05 R	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	2.1 Q	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	2.36	3.18	0.33	ND	0.23	0.02	0.23	0.04 R	0.06 Q	0.27	0.06 Q	ND	0.01 R	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCBs	ND	ND	0.94	ND	ND	ND	0.33	0.51	0.35	ND	ND	ND	ND	ND	ND

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Concentrations in mg/kg (parts per million equivalent)
Analysis using ERM-FAST™ probe

Table 2-5
Summary of Qualitative Field Results - Shallow Soils
BASF Corporation - South Works
Wyandotte, Michigan

Compound (mg/kg)	SSP-31	SSP-32	SSP-33	SSP-34	SSP-35	SSP-36	SSP-37	SSP-38	SSP-39	SSP-40	SSP-41	SSP-42	SSP-43	SSP-44	SSP-45
Priority Pollutant Metals															
Potassium (%)	ND	1.6	2.0	0.8	1.6	ND	ND	2.0	2.1	0.9	ND	2.3	1.8	2.6	1.8
Calcium (%)	ND	5.4	4.6	19.5	5.4	ND	ND	4.9	1.7	22.0	25.1	11.3	9.0	5.8	11.1
Iron (%)	ND	3.0	3.1	2.7	2.8	ND	ND	3.0	2.7	2.3	3.7	3.3	3.4	4.0	3.8
Arsenic	ND	ND	7.4	33.7	12.6	ND	ND	ND	4.7	4.1	ND	ND	2.0	18.2	14.5
Lead	ND	102.0	24.8	227.4	53.4	ND	ND	59.7	55.1	114.4	685.6	31.3	127.6	27.4	31.0
Mercury	ND	ND	ND	27.9	ND	ND	ND	6.0	1.6	ND	94.6	2.4	ND	0.7	ND
Priority Pollutant Volatiles															
Acetone	5.1	ND	0.05 Q	0.09 Q	0.05 R	0.08 Q	0.03 R	1.99	0.05 R	0.04 R	ND	0.03 R	0.04 R	0.07 Q	0.05 Q
Benzene	0.04 R	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	0.044	ND	0.02 R	0.05 Q	0.03 R	0.02 R	ND	0.02 R	0.02 R	0.03 R	0.04 R	0.01 R	0.02 R	0.06 Q	0.04 R
1,2-Dichloroethane	ND	ND	ND	ND	ND	0.04 R	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	0.04 R	0.03 R	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorpropane	26.9	ND	ND	ND	ND	ND	ND	6.604	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	0.04 R	ND	0.01 R	ND	0.02 R	0.01 R	0.01 R	0.02 R	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.02 R	ND	0.01 R	0.01 R	0.01 R	ND	ND	ND	ND	0.01 R	ND	ND	0.01 R	0.04 R	0.01 R
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	0.004 R	0.01 R	0.01 R	0.004 R	ND	0.01 R	0.01 R
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Priority Pollutant Semi-Volatiles															
bis(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.55	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	0.16	ND	0.04 R	ND	ND	ND	0.11 Q	0.03 R	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	0.8	ND	ND	ND	19.43	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16 Q	ND
Anthracene	ND	ND	ND	ND	ND	0.12 R	ND	ND	ND	2.96 Q	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12 Q	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12 Q	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	0.05 R	0.02 R	0.06 Q	0.01 R	0.27	0.04 R	0.04 R	ND	6.51	0.08 Q	0.01 R	ND	0.29	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	0.16	ND	ND	ND	9.44	ND	ND	ND	ND	ND
PCBs	ND	ND	ND	ND	ND	0.62	0.41	ND	ND	1.88	2.34	ND	ND	ND	ND

ND indicated analyzed, but not detected
Q: This is a quantitatively questionable result.
R: This is a quantitatively unreliable result.
Concentrations in mg/kg (parts per million equivalent)
Analysis using ERM-FAST™ probe

Table 2-6
Summary of Qualitative Field Results - Soil Borings
BASF Corporation - South Works
Wyandotte, Michigan

Compound (mg/kg) Depth in feet	DB-1* 2-4	DB-1* 7-9	DB-1* 9.5-11.5	DB-1* 12-14	DB-1 (DUP) 12-14	DB-1* 14-15	DB-2* 0-2	DB-2* 3-5	DB-2* 5.5-7.5	DB-2 5.5-7.5	DB-2* 8-10	DB-2* 10.5-12.5	DB-3* 0-2	DB-3* 8-10	DB-3* 13-15	DB-4* 0-2	DB-4* 10.5-12.5	DB-4* 13-15	DB-2** 10.5-12.5
Priority Pollutant Metals																			
Potassium (%)	1.1	2.3	2.1	2.0		2.0	0.9	1.0	1.4		1.7	1.8	1.0	1.7	1.9		1.9	1.8	
Calcium (%)	10.0	0.6	2.2	9.3		8.9	10.9	4.5	4.3		9.3	9.2	8.6	7.8	10.2		10.1	9.7	
Iron (%)	5.4	3.5	3.2	2.8		3.6	3.9	5.2	3.4		3.2	2.9	32.3	2.8	3.0		2.9	2.9	
Arsenic		7.6	3.6	12.0		26.1	4.3	15.4	5.8			17.5		13.3	10.5		25.0	12.8	
Lead	607.3	30.5	28.5	19.1		20.9	279.1	377.4	589.3		200.1	21.9	1418.9	14.2	22.7		10.2	14.4	
Mercury																			
Priority Pollutant Volatiles																			
Acetone	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	1.2
Chloroform	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	0.2
1,1-Dichloroethane	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
1,2-Dichloroethane	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
1,1-Dichloroethene	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
1,2-Dichloroethene (total)	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
Dichloromethane	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	0.3
1,2-Dichloropropane	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
2-Hexanone	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
Toluene	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	0.2
Tetrachloroethene	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
1,1,1-Trichloroethane	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
1,1,2-Trichloroethane	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
Trichloroethene	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	14.2
Vinyl chloride	#	#	#	#		#	#	#	#		#	#	#	#	#	#	#	#	
Priority Pollutant Semivolatiles																			
bis(2-Chloroethyl)ether																			
bis(2-Chloroisopropyl) ether																			
Hexachlorobenzene																			
Pentachlorophenol																			
3,3'-Dichlorobenzidine																			
Octylphthalate																			
Acenaphthene	27.57											28.3							
Acenaphthylene																			
Phenanthrene																			
Anthracene	26.15							0.1 Q	2.93	0.05 R	0.24	16.93							
Benzo(b)fluoranthene																			
Benzo(k)fluoranthene																			
Benzo(a)pyrene							0.04 R	0.19			0.23	7.97							
Chrysene																			
Benzo(a)anthracene										0.04 R								0.004 R	
Benzo(ghi)perylene																			
Indeno(1,2,3-cd)pyrene																			
Dibenzo(ah)anthracene									6.6										
Pyrene																			
Fluoranthene	18.2		0.01 R	0.06 Q	0.01 Q		0.076	0.14 Q	3.23	0.26	0.21	14.82	0.08 Q					0.01 R	
Naphthalene									27.56				1.74 Q			53.5			
Fluorene	8.33		0.13 Q						0.37			8.55							
3,4-Benzofluoranthene																			
TPH																			
PCBs	3.32											2.15							

Blank spaces indicate analyzed, but not detected.
*Analysis for Priority Pollutant Volatiles performed using GC/MS.
**Analysis using probe and acetone matrix
Data for priority pollutant volatiles appears on quantitative data Table 2-8.
Q: This is a quantitatively questionable result.
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Table 2-6
Summary of Qualitative Field Results - Soil Borings
BASF Corporation - South Works
Wyandotte, Michigan

Compound (mg/kg)	DB-5**	DB-5**	DB-5**	DB-5	DB-6**	DB-6**	DB-6	DB-6**	DB-7**	DB-7**	DB-7**	DB-8**	DB-8	DB-8**	DB-8**	DB-8**	DB-9**	DB-9
Depth in feet	0-2	8-10	13-15	13-15	0-2	8-10	9.5-11.5	13-15	3-5	8-10	13-15	0-2	0-2	3-5	5.5-7.5	8-10	10.5-12.5	0-2	3-5
Priority Pollutant Metals																			
Potassium (%)	0.0	1.0	2.2		0.8		2.6	0.3	0.2	0.7	1.4	0.5		1.6	0.7	1.0	0.8	1.1	
Calcium (%)	16.5	1.8	9.3		11.2		4.2	11.4	9.9	5.6	8.7	10.2		5.2	7.7	1.6	4.7	12.1	25.1
Iron (%)	3.1	1.2	3.0		4.2		5.1	6.7	2.1	1.9	2.6	1.3			1.9	1.9	1.6	2.6	2.6
Arsenic	48.6	11.9	5.8		57.3		21.0	1949.4	11.5	2.2	10.1	6.6				8.0	11.7	5.5	87.3
Lead	177.6	6.4	18.7		204.5		17.6	1801.1	42.7	33.7	13.3	58.4		48.5	59.5	30.0	46.0	76.1	44.3
Mercury					4.3			98.8										44.5	130.4
Priority Pollutant Volatiles																			
Acetone	0.35	1.9	1.1		0.3	0.2		0.27 R	0.2	0.4	0.4	0.2		0.2	0.3	0.2	0.4	0.3	0.1
Chloroform		0.05	0.05 R		0.06 Q			0.01 Q		0.05 Q	0.1 Q	0.1 Q			0.1	0.1 Q		0.1 Q	0.1 Q
1,1-Dichloroethane																			0.5
1,2-Dichloroethane											0.2								
1,1-Dichloroethene																			
1,2-Dichloroethene (total))																			
Dichloromethane			0.13 Q																
1,2-Dichloropropane																			
2-Hexanone																			
Toluene								0.03 R	0.2	0.1 Q		0.04 R			0.03 R	.01 Q	4.4		0.1 Q
Tetrachloroethene																			
1,1,1-Trichloroethane																	0.02 R		
1,1,2-Trichloroethane																			
Trichloroethene											0.7 Q								
Vinyl chloride																			
Priority Pollutant Semivolatiles																			
bis(2-Chloroethyl)ether																			
bis(2-Chloroisopropyl) ether																			
Hexachlorobenzene																	0.09 Q		
Pentachlorophenol																			
3,3'-Dichlorobenzidine																			
Octylphthalate																			
Acenaphthene				0.33															
Acenaphthylene														0.97					
Phenanthrene																			
Anthracene														2.94 Q			0.37 Q		0.58 Q
Benzo(b)fluoranthene																			
Benzo(k)fluoranthene																			
Benzo(a)pyrene				1.84															
Chrysene																			
Benzo(a)anthracene																			
Benzo(ghi)perylene																			
Indeno(1,2,3-cd)pyrene				1.14															
Dibenzo(ah)anthracene				3.5															
Pyrene																			
Fluoranthene				1.71	0.02 R				0.02 R			0.5		1.62	0.09 Q	0.05 R	0.52	0.37	0.51
Naphthalene		2.29 R	3.41 Q	9.23						28.92									
Fluorene				1.97										0.37			9.44		0.37
3,4-Benzofluoranthene																			
TPH																			
PCBs												2.3	2.3						

Blank spaces indicate analyzed, but not detected.
*Analysis for Priority Pollutant Volatiles performed using GC/MS.
**Analysis using probe and acetone matrix
Data for priority pollutant volatiles appears on quantitative data Table 2-8.
Q: This is a quantitatively questionable result.
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Table 2-6
Summary of Qualitative Field Results - Soil Borings
BASF Corporation - South Works
Wyandotte, Michigan

Compound (mg/kg) / Depth in feet	DB-9** 5.5-7.5	DB-10** 0-2	DB-10** 5.5-7.5	DB-10** 13-15	DB-11** 0-2	DB-11** 3-5	DB-11** 5.5-7.5	DB-11** 8-10	DB-12** 0-2	DB-12** 3-5	DB-12 3.5-5.5	DB-12** 5.5-7.5	DB-12** 8-10	DB-13** 0-2	DB-13** 8-10	DB-13** 10.5-12.5	DB-13** 13-15	DB-14** 0-2	DB-14** 5.5-7.5
Priority Pollutant Metals																			
Potassium (%)		1.4		0.2	0.6	1.3		1.1	1.8					2.0	1.1	1.8	1.9	1.6	1.2
Calcium (%)		10.0	26.4	8.5	20.3	10.9	23.6	12.2	7.8		48.4	46.8	41.7	11.4	2.4	9.9	9.9	4.5	9.3
Iron (%)		3.3	4.9	1.5	3.6	2.9	1.0	3.2	2.6		0.8	0.9	0.5	3.8	2.2	3.0	2.9	2.8	2.9
Arsenic		19.5	25.4	2.6	83.4	51.1	5.8						1.5	11.3	3.3	15.6	15.4	12.3	5.6
Lead		144.0	38.3	9.4	717.8	298.7	159.2	151.6	88.6		411.8	174.8	32.2	128.3	21.1	9.2	13.9	63.2	
Mercury					79.6	2541.7	276.5	1195.5			4.4	436.6	50.4						86.5
Priority Pollutant Volatiles																			
Acetone	0.1 Q	0.2	0.3	0.2	0.2	0.3	0.2	0.2				0.3		0.3	1.4	1.4	0.4	1.1	24.3
Chloroform		0.1 Q	0.1 Q	0.1 Q	0.1	0.1 Q	0.1 Q	0.1 Q		0.1 Q			0.1 Q	0.1 Q	0.1 Q	0.2	0.2	0.1	0.3
1,1-Dichloroethane														0.3					
1,2-Dichloroethane	0.2		0.2				0.2												
1,1-Dichloroethene																			
1,2-Dichloroethene (total)																			
Dichloromethane																			
1,2-Dichloropropane																			202.8
2-Hexanone																			
Toluene			0.05R			0.1 Q	0.1 Q	0.1 Q											
Tetrachloroethene																			
1,1,1-Trichloroethane				0.02 R			0.03 R			0.03 R			0.02 R	0.02 R	0.01 R	0.1 Q	0.02 R	0.03R	0.1 Q
1,1,2-Trichloroethane																			2.4
Trichloroethene																			
Vinyl chloride															11.7	24.3	0.8		
Priority Pollutant Semivolatiles																			
bis(2-Chloroethyl)ether																			
bis(2-Chloroisopropyl) ether																			
Hexachlorobenzene	0.08								0.27			1.05						0.44	
Pentachlorophenol																			
3,3'-Dichlorobenzidine																			
Octylphthalate																			
Acenaphthene												23.94							
Acenaphthylene									0.49										
Phenanthrene																			
Anthracene																			
Benzo(b)fluoranthene																			
Benzo(k)fluoranthene																			
Benzo(a)pyrene																			
Chrysene																			
Benzo(a)anthracene																			
Benzo(ghi)perylene																			
Indeno(1,2,3-cd)pyrene																			
Dibenzo(ah)anthracene																			
Pyrene																			
Fluoranthene	0.39								0.13			0.25							0.12 Q
Naphthalene																			101
Fluorene																			
3,4-Benzofluoranthene																			
TPH																			
PCBs	5.61																	12.23	

Blank spaces indicate analyzed, but not detected.
*Analysis for Priority Pollutant Volatiles performed using GC/MS.
**Analysis using probe and acetone matrix
Data for priority pollutant volatiles appears on quantitative data Table 2-8.
Q: This is a quantitatively questionable result.
R: This is a quantitatively unreliable result.

Table 2-6
Summary of Qualitative Field Results - Soil Borings
BASF Corporation - South Works
Wyandotte, Michigan

Compound (mg/kg)	DB-14**	DB-15**	DB-15**	DB-15**	DB-15**	DB-15**	DB-16**	DB-16**	DB-16**	DB-16	DB-17**	DB-17**	DB-18**	DB-18**	DB-18**
Depth in feet	10.5-12.5	0-2	3-5	5.5-7.5	10.5-12.5	13-15	0-2	3-5	5.5-7.5	13-15	0-2	8-10	0-2	8-10	13-15
Priority Pollutant Metals															
Potassium (%)	1.4	2.3	1.0	1.7	1.8	2.1	0.8		1.9	1.8	1.3			0.3	1.8
Calcium (%)	1.3	1.3	1.1	1.3	9.3	10.3			0.9	9.5	22.4		19.3	22.0	9.0
Iron (%)	1.8	2.6	1.3	3.2	2.8	3.0	5.3		2.5	4.2	3.0		7.3	3.3	2.5
Arsenic	10.9	7.5	5.9	23.3	11.5	20.8			11.5	21.3	15.4		110.3	25.0	5.7
Lead	13.0	35.0	19.1	9.1	9.5	19.3	731.5		19.5	21.1	43.8		94.4	83.1	
Mercury			4.2										9.7	56.6	
Priority Pollutant Volatiles															
Acetone	15.1	0.04 R	8.5	2.3	1.3	0.5	0.05 R	0.02 R	0.03 R	0.5	0.04 R	19.5	0.2	0.1 Q	0.1 Q
Chloroform		0.02 R	0.1 Q	0.05 R	0.02 R				0.01 R		0.01 R	0.1 Q	0.04 R	0.05 R	2.8
1,1-Dichloroethane															
1,2-Dichloroethane												0.03 R			
1,1-Dichloroethene															
1,2-Dichloroethene (total)															
Dichloromethane															0.6
1,2-Dichloropropane	398.6		17.9	6.0	33.3	15.9				16.0					
2-Hexanone															
Toluene			0.04 R	0.1 Q	0.02 R		0.01 R	0.01 R	0.01 R				0.03 R	0.01 R	
Tetrachloroethene															
1,1,1-Trichloroethane		0.004 R	0.01 R	0.01 R	0.01 R				0.04 R		0.03 R				0.01 R
1,1,2-Trichloroethane															
Trichloroethene															
Vinyl chloride												167.8	0.04 R	0.05 R	
Priority Pollutant Semivolatiles															
bis(2-Chloroethyl)ether															
bis(2-Chloroisopropyl) ether			30.53												
Hexachlorobenzene													0.67	0.01	
Pentachlorophenol															
3,3'-Dichlorobenzidine															
Octylphthalate															
Acenaphthene															
Acenaphthylene															
Phenanthrene															
Anthracene											0.07 Q				
Benzo(b)fluoranthene															
Benzo(k)fluoranthene															
Benzo(a)pyrene															
Chrysene															
Benzo(a)anthracene															
Benzo(ghi)perylene															
Indeno(1,2,3-cd)pyrene															
Dibenzo(ah)anthracene															
Pyrene															
Fluoranthene							0.14 Q				0.08 Q		0.32	0.39	
Naphthalene				39.86					3.71						
Fluorene															
3,4-Benzofluoranthene															
TPH															
PCBs														1.77	

Blank spaces indicate analyzed, but not detected.
*Analysis for Priority Pollutant Volatiles performed using GC/MS.
**Analysis using probe and acetone matrix
Data for priority pollutant volatiles appears on quantitative data Table 2-8.
Q: This is a quantitatively questionable result.
R: This is a quantitatively unreliable result.

samples collected for ERM-FAST℠ analysis (SSP-3, SSP-4, SSP-5, SSP-6, SSP-7, SSP-8, SSP-9, SSP-10, SSP-11, SSP-12, SSP-13, SSP-14, SSP-15, SSP-18, SSP-20, SSP-22, SSP-23, SSP-24, SSP-25, SSP-26, SSP-27, SSP-30, SSP-31, SSP-34, and SSP-41). PCBs were detected in four surface soil samples, but concentrations were less than 3 mg/kg, below the EPA recommended cleanup level of 10 mg/kg.

Relatively low levels of both volatile and semi-volatile compounds were detected in several surface and deep boring soil samples across the Site. The volatile results can be primarily categorized into chlorinated ethenes and petroleum hydrocarbons, while the semi-volatile compounds can be primarily categorized into polynuclear aromatic hydrocarbons (PNAs) (typical components of coal and asphalt by-products).

2.4 Quantitative Investigation

2.4.1 Approach

Based on the results of these activities, a strategy was developed to collect quantitative analytical data for use in the risk assessment. Quantitative data activities included a shallow soil investigation, deep soil boring investigation, and ground water sampling.

2.4.2 Shallow Soil Sampling

Due to the limited soil characterization data available for the Site, shallow soil samples were collected from identified areas of interest. Multiple shallow soil sampling events were conducted. The purpose of the multiple shallow soil sampling and analysis events was to characterize the current soil conditions of the areas of interest identified in the qualitative assessment and to provide quantitative input to the risk assessment.

At the initial sampling event, a discrete soil sample was collected from two intervals at eight locations: at ground surface (6 to 12 inches below grade and given a suffix letter designation "A") and at a shallow depth (approximately two to four feet below grade and given a suffix letter designation "B"). At subsequent shallow soil sampling events, a discrete soil sample was collected at the ground surface to a maximum depth of four feet. These samples were designated with either a prefix "P-", "SSB-", or "SSP-", based on the date of the sampling event. Figure 2-6 depicts the shallow soil sample locations. Details of the sample collection are presented in Appendix C.

The analytical results for the shallow soil samples are summarized in Table 2-7. Laboratory data sheets are included in Appendix F and Chain-of-Custody forms are presented in Appendix G. Samples were analyzed for at least one of the following parameters: priority pollutant volatile organics (EPA Method SW-846 8240), priority pollutant semi-volatile organics (EPA Method SW-846 8270), polynuclear aromatic hydrocarbons (EPA Method SW-846 8100), priority pollutant metals (various EPA and SW-846 Methods, depending upon the parameter), and PCBs (EPA Method 8080). In addition, selected samples were analyzed for asbestos. Analytical parameters are only listed in Table 2-7 if they were detected in at least one sample.

Selected shallow soil samples (S1A, S1B, S8A, S8B, and P15) were sent to Accumin Analysis, Inc. for asbestos analysis using a polarized microscope (EPA Method 600/M4-82-020). The analytical results indicate that asbestos was detected in only one of the samples analyzed (S8B at less than 1% chrysotile).

The shallow soil sample analytical results indicated elevated levels of selected metals, particularly arsenic (S1B, S3B, S6B, and S7B); lead (S2B, S3B, S5B, S7A, S7B, and SSB-56); mercury (S3B, S4B, S5B, S6A, S6B, S7A, S7B, SSB-54, and SSB-61); and zinc (S3A, S5A, and S5B) in several of the shallow soil samples. Elevated levels of chromium (S3A, S5A, S5B, S7A, and S8A) and nickel (S3B) were also noted in selected shallow soil samples.

All but three of the shallow thirty-eight soil samples analyzed (S3A, S5A, and S8A) contained detectable concentrations of one or more volatile organic compounds (VOCs). However, most of the concentrations of the various compounds were low, meaning they were detected near the quantitation limit. Toluene and 1,2-dichloropropane were the most common VOCs detected. Seventeen different volatile organic compounds were detected in the thirty-eight shallow soil samples analyzed.

All but nine of the shallow twenty-nine soil samples analyzed (S2A, S2B, S4A, S8A, P15, SSB-46, SSB-50, SSB-59, and SSB-60) contained detectable concentrations of several semi-volatile organic compounds. Seventeen different semi-volatile compounds were detected in the thirty-seven shallow soil samples analyzed. Samples S1B and SSB-47 contained the highest concentrations of five of the compounds detected.

Nine of the shallow twenty-nine soil samples analyzed contained detectable concentrations of PCBs (S3B, S4B, S5A, S5B, S7A, S7B, SSB-51, SSB-52, and SSB-62), specifically PCB-1254. Samples

Table 2-7
Summary of Quantitative Results - Shallow Soils
BASF Corporation - South Works
Wyandotte, Michigan

Analytical Parameter	U.S. Soil Back-ground	Michigan Soil Back-Ground	S1A	S1B	S2A	S2B	S3A	S3B	S4A	S4B	S5A	S5B	S6A	S6B	S7A	S7B	S8A	S8B	*Site Background* P15 0-6"	*Site Background* P15 2-2.5'
Moisture (%)																				
Priority Pollutant Metals																				
Arsenic	0.1 - 40	0.7 - 15.9	11.8	18.0	6.7	4.5	4.6	32.8	5.0	4.9	4.8	6.0	3.9	39.0	52.9	7.7	7.0	2.6	10	2.0
Cadmium	N/E	1.0 - 1.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	50 - 170	3.0 - 24.5	21	10	21	17	49	15	20	17	25	45	17	16	24	21	56	12	18	20
Copper	2 - 200	4.5 - 82.5	23	16	17	31	44	66	17	17	26	55	7	17	30	16	36	10	9	12
Lead	2 - 200	6 - 56	77	41	12	110	59	184	13	83	61	195	27	42	138	101	51	22	28	ND
Mercury	0.01 - 4.6	0.04 - 0.50	0.34	0.26	ND	ND	ND	3.85	ND	172.0	0.43	0.98	0.68	2.85	8.24	11.2	ND	ND	0.35	ND
Nickel	10 - 40	2.5 - 16	19	6	24	14	26	206	21	10	18	19	7	11	21	43	42	11	7	7
Zinc	10 - 300	18 - 79	88	25	54	86	111	87	39	43	128	299	28	41	107	38	103	20	46	22
Priority Pollutant Volatiles																				
Benzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.17	ND	ND	ND	ND	ND	ND	0.017	0.009
1,1-Dichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	0.017	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	N/E	N/E	ND	ND	ND	ND	ND	0.21	ND	0.005	ND	0.92	ND	ND	0.005	0.008	ND	ND	0.030	0.011
Ethylbenzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.012	ND	0.012	ND	0.008	ND	ND
Methylene Chloride	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	N/E	N/E	ND	ND	ND	ND	ND	0.14	ND	ND	ND	ND	ND	ND	ND	0.015	ND	ND	ND	ND
Toluene	N/E	N/E	0.006	0.014	ND	ND	ND	0.005	ND	0.006	ND	0.006	ND	0.022	ND	0.006	ND	0.010	ND	ND
Trans-1,2-Dichloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	N/E	N/E	ND	0.026	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	N/E	N/E	0.006	0.009	0.012	0.006	ND	ND	0.007	ND	ND	ND	0.007	0.012	ND	ND	ND	0.005	ND	ND
1,1,2-Trichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Priority Pollutant Semi-Volatiles																				
Acenaphthene	N/E	N/E	ND	0.53	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	N/E	N/E	ND	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	N/E	N/E	0.93	2.9	ND	ND	ND	1.2	ND	0.5	0.33	0.43	0.4	0.57	ND	0.6	ND	ND	ND	ND
Benzo(a)pyrene	N/E	N/E	0.77	1.9	ND	ND	0.8	0.7	ND	0.4	0.6	0.33	0.47	0.37	ND	0.47	ND	ND	ND	ND
3,4-Benzofluoranthene	N/E	N/E	0.7	2.9	ND	ND	0.9	0.77	ND	0.57	0.7	0.46	0.432	ND	0.37	0.77	ND	ND	ND	ND
Benzo(g,h,i)perene	N/E	N/E	0.93	1.4	ND	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	N/E	N/E	ND	ND	ND	ND	0.77	0.78	ND	0.4	ND	ND	ND	ND	ND	0.37	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether	N/E	N/E	ND	ND	ND	ND	ND	0.71	ND	ND	3.4	8.3	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	N/E	N/E	1.0	3.3	ND	ND	0.93	1.0	ND	0.6	0.47	0.57	0.432	0.73	0.4	0.6	ND	ND	ND	ND
Dibenzo(a,h)anthracene	N/E	N/E	ND	ND	ND	ND	ND	1.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	N/E	N/E	1.4	5.7	ND	ND	1.6	1.8	ND	0.87	0.63	0.6	0.33	ND	0.37	0.9	ND	ND	ND	ND
Fluorene	N/E	N/E	ND	0.83	ND	ND	ND	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.93	ND	ND	ND	ND	ND	ND
Indeno (1,2,3-cd)pyrene	N/E	N/E	0.37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Methylnaphthalene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	0.33	ND	0.53	ND	ND
2-Methylnaphthalene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	N/E	N/E	ND	3.0	ND	ND	ND	0.63	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	N/E	N/E	0.7	5.3	ND	ND	0.87	1.6	ND	0.77	0.6	0.7	0.8	3.3	0.47	1.0	ND	0.37	ND	ND
Pyrene	N/E	N/E	2.0	9.0	ND	ND	2.1	2.0	ND	1.2	0.97	0.97	0.73	1.1	0.67	1.4	ND	ND	ND	ND
PCBs																				
PCB-1254	10	1	ND	ND	ND	ND	ND	2.36	ND	0.705	1.55	8.19	ND	ND	0.472	0.663	ND	0.06J	ND	ND

NOTES:

1. Concentrations in mg/kg (parts per million equivalent)
2. Compounds listed only if present in at least one sample
3. ND - Compound not present above method detection limits
4. S1A - Sample location 1 collected at a 6-12 inch depth
5. SS8-47 and S1B - Sample location 1 collected at a 2-3 feet depth
6. Background level of elements in soils, Criteria For Contaminated Soil/Sediment Cleanup, J. Fitchko, 1989
7. Michigan Background level of elements in soils, Waste Management Division, Michigan Dept. of Natural Resources, 12/21/87.
8. N/E - Not established
9. N/A - Not available
10. J - This result is a quanitative estimate. See text for clarification

Table 2-7
Summary of Quantitative Results - Shallow Soils
BASF Corporation - South Works
Wyandotte, Michigan

Analytical Parameter	U.S. Soil Back-ground	Michigan Soil Back-Ground	SSB-46	SSB-46MS	SSB-46MSD	SSB-47	SSB-48	SSB-48MS	SSB-49	SSB-49MS	SSB-50	SSB-51	SSB-52	SSB-52MS	SSB-52MSD	SSB-53	SSB-53MS	SSB-54	SSB-55
Moisture (%)			16.1	14	18.7	17.5	10.5	11.7	11.4	12.1	16.1	13.4	13.5	13.3	13.5	13.1	9.8	29.3	12.6
Priority Pollutant Metals																			
Arsenic	0.1 - 40	0.7 - 15.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	N/E	1.0 - 1.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	50 - 170	3.0 - 24.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	2 - 200	4.5 - 82.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	2 - 200	6 - 56	N/A	N/A	N/A	N/A	6.8 J	4.3 J	33.5 J	N/A	21.2 J	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12 J
Mercury	0.01 - 4.6	0.04 - 0.50	N/A	N/A	N/A	N/A	0.59	N/A	ND	ND	ND	N/A	N/A	N/A	N/A	ND	ND	10 8	0.29
Nickel	10 - 40	2.5 - 16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	10 - 300	18 - 79	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Priority Pollutant Volatiles																			
Benzene	N/E	N/E	ND	0.059	0.059	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	0 01	0.007
Carbon Tetrachloride	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	0.023	ND
Chlorobenzene	N/E	N/E	ND	0.007	0.066	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	ND	0.016
Chloroform	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	0.198	ND
1,1-Dichloroethane	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	ND	ND
1,1-Dichloroethene	N/E	N/E	ND	0.057	0.052	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	ND	ND
1,2-Dichloroethane	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	ND	0.097
1,2-Dichloropropane	N/E	N/E	ND	ND	ND	0.255	0.123	N/A	0.064	N/A	0.215	0.11	0.254	N/A	N/A	0.138	N/A	0.041	0.066
Ethylbenzene	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	0.016	ND
Methylene Chloride	N/E	N/E	ND	ND	ND	0.011	ND	N/A	0.019	N/A	0.017	0.014	0.015	N/A	N/A	ND	N/A	ND	0.017
Tetrachloroethene	N/E	N/E	0.227	0.546	0.172	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	0.368 J	ND
Toluene	N/E	N/E	ND	0.007	0.074	0.012	ND	N/A	0.012	N/A	0.014	0.015 J	0.014	N/A	N/A	0.014 J	N/A	0.007 J	0 021
Trans-1,2-Dichloroethene	N/E	N/E	0.008	0.028	ND	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	ND	ND
Trichloroethene	N/E	N/E	3.46	22.1	22.1	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	0.034	ND
Trichlorofluoromethane	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	0.11	ND
1,1,2-Trichloroethane	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	ND	ND
Vinyl Chloride	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	ND	ND	N/A	N/A	ND	N/A	ND	ND
Priority Pollutant Semi-Volatiles																			
Acenaphthene	N/E	N/E	ND	1.51	1.6	ND	ND	N/A	ND	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Anthracene	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)anthracene	N/E	N/E	ND	ND	ND	0.812	ND	N/A	0.971	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	N/E	N/E	ND	ND	ND	0.74	ND	N/A	0.632	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3,4-Benzofluoranthene	N/E	N/E	ND	ND	ND	0.8	ND	N/A	0.643	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(g,h,i)perene	N/E	N/E	ND	ND	ND	0.509	ND	N/A	0.418	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	N/E	N/E	ND	ND	ND	0.728	ND	N/A	0.689	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-Chloroisopropyl)ether	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chrysene	N/E	N/E	ND	ND	ND	0.994	ND	N/A	0.926	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenzo(a,h)anthracene	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fluoranthene	N/E	N/E	ND	ND	ND	0.982	ND	N/A	1.81	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fluorene	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hexachlorobenzene	N/E	N/E	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Indeno (1,2,3-cd)pyrene	N/E	N/E	ND	ND	ND	0.437	ND	N/A	0.373	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1-Methylnaphthalene	N/E	N/E	ND	ND	ND	2.06	0.424	N/A	ND	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylnaphthalene	N/E	N/E	ND	ND	ND	2.55	0.603	N/A	ND	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Naphthalene	N/E	N/E	ND	ND	ND	1.46	ND	N/A	ND	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phenanthrene	N/E	N/E	ND	ND	ND	2.18	0.335	N/A	1.92	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pyrene	N/E	N/E	ND	1.98	2.21	1.46	ND	N/A	2.14	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCBs																			
PCB-1254	10	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2 15	1.1	0.884	0.966	N/A	N/A	N/A	ND

NOTES:

1. Concentrations in mg/kg (parts per million equivalent)
2. Compounds listed only if present in at least one sample
3. ND - Compound not present above method detection limits
4. S1A - Sample location 1 collected at a 6-12 inch depth
5. SSB-47 and S1B - Sample location 1 collected at a 2-3 feet depth
6. Background level of elements in soils, Criteria For Contaminated Soil/Sediment Cleanup, J. Fitchko, 1989
7. Michigan Background level of elements in soils, Waste Management Division, Michigan Dept. of Natural Resources, 12/21/87.
8. N/E - Not established
9. N/A - Not available
10. J - This result is a quantitative estimate. See text for clarification

Table 2-7
Summary of Quantitative Results - Shallow Soils
BASF Corporation - South Works
Wyandotte, Michigan

Analytical Parameter	U.S. Soil Back-ground	Michigan Soil Back-Ground	SSB-55MS	SSB-56	SSB-56MS	SSB-56MSD	SSB-57	SSB-58	SSB-58MS	SSB-58MSD	SSB-59	SSB-60	SSB-61	SSB-62	SSB-63	SSB-63MS	SSB-64	SSB-65
Moisture (%)			20.7	19.4	15.4	16.9	13.4	20.6	19.8	32.1	17.3	41.5	14.5	16.1	14	14.9	22	21.2
Priority Pollutant Metals																		
Arsenic	0.1 - 40	0.7 - 15.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	N/E	1.0 - 1.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	50 - 170	3.0 - 24.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	2 - 200	4.5 - 82.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	2 - 200	6 - 56	8.7 J	507 J	N/A	N/A	N/A	N/A	N/A	N/A	5.8 J	16.2 J	72.7 J	N/A	N/A	N/A	N/A	35.8 J
Mercury	0.01 - 4.6	0.04 - 0.50	N/A	1.61	N/A	N/A	2.31	N/A	N/A	N/A	ND	ND	15.3	1.18	2.12	2.11	0.52	1.88
Nickel	10 - 40	2.5 - 16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	10 - 300	18 - 79	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Priority Pollutant Volatiles																		
Benzene	N/E	N/E	N/A	ND	8.51	9.27	0.007	0.315	N/A	N/A	ND	ND	ND	ND	ND	N/A	0.01	ND
Carbon Tetrachloride	N/E	N/E	N/A	ND	ND	ND	ND	ND	N/A	N/A	ND	ND	ND	ND	ND	N/A	ND	ND
Chlorobenzene	N/E	N/E	N/A	ND	8.74	9.39	ND	ND	N/A	N/A	ND	ND	ND	ND	ND	N/A	0.022 J	ND
Chloroform	N/E	N/E	N/A	3.35	2.6	4.81	0.008	ND	N/A	N/A	ND	ND	ND	ND	0.038	N/A	ND	ND
1,1-Dichloroethane	N/E	N/E	N/A	ND	ND	ND	ND	ND	N/A	N/A	ND	ND	ND	ND	ND	N/A	ND	ND
1,1-Dichloroethene	N/E	N/E	N/A	ND	6.26	6.5	ND	ND	N/A	N/A	ND	ND	ND	ND	ND	N/A	ND	ND
1,2-Dichloroethane	N/E	N/E	N/A	ND	ND	ND	0.021	ND	N/A	N/A	ND	ND	ND	ND	0.043	N/A	1.26	ND
1,2-Dichloropropane	N/E	N/E	N/A	1860	1300	1440	0.054	0.097	N/A	N/A	0.008	0.01	0.046	0.081	0.086	N/A	0.5	0.039
Ethylbenzene	N/E	N/E	N/A	ND	ND	ND	ND	0.035	N/A	N/A	ND	ND	ND	ND	0.016	N/A	ND	0.008
Methylene Chloride	N/E	N/E	N/A	ND	ND	ND	0.021	0.02	N/A	N/A	ND	0.036	0.068	0.06	0.047	N/A	ND	0.091
Tetrachloroethene	N/E	N/E	N/A	ND	ND	ND	0.009	ND	N/A	N/A	ND	ND	ND	0.069	ND	N/A	ND	ND
Toluene	N/E	N/E	N/A	ND	8.39	9.15	0.014	0.028	N/A	N/A	ND	ND	0.026 J	0.038	0.023	N/A	0.009 J	0.025
Trans-1,2-Dichloroethene	N/E	N/E	N/A	ND	ND	ND	ND	ND	N/A	N/A	ND	ND	ND	ND	ND	N/A	ND	ND
Trichloroethene	N/E	N/E	N/A	ND	7.8	4.69	ND	ND	N/A	N/A	ND	ND	ND	0.019	ND	N/A	ND	0.01
Trichlorofluoromethane	N/E	N/E	N/A	ND	ND	ND	0.055	0.038	N/A	N/A	ND	ND	ND	0.062	0.019	N/A	ND	0.018
1,1,2-Trichloroethane	N/E	N/E	N/A	ND	ND	ND	ND	ND	N/A	N/A	ND	ND	ND	ND	ND	N/A	ND	ND
Vinyl Chloride	N/E	N/E	N/A	ND	ND	ND	ND	ND	N/A	N/A	ND	ND	ND	ND	ND	N/A	0.141	ND
Priority Pollutant Semi-Volatiles																		
Acenaphthene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	1.750	2.210	ND	ND	ND	ND	N/A	N/A	N/A	ND
Anthracene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
Benzo(a)anthracene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
Benzo(a)pyrene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
3,4-Benzofluoranthene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
Benzo(g,h,i)perene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
Benzo(k)fluoranthene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
bis(2-Chloroisopropyl)ether	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
Chrysene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
Dibenzo(a,h)anthracene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
Fluoranthene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	0.444	ND	N/A	N/A	N/A	ND
Fluorene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
Hexachlorobenzene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
Indeno (1,2,3-cd)pyrene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	ND
1-Methylnaphthalene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	1.64 J	2.120	2.060	ND	ND	ND	0.346 J	N/A	N/A	N/A	ND
2-Methylnaphthalene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	2.14 J	2.620	2.360	ND	ND	0.515	0.477 J	N/A	N/A	N/A	0.469 J
Naphthalene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	1.26 J	1.750	1.920	ND	ND	0.351	ND	N/A	N/A	N/A	ND
Phenanthrene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	0.831 J	1.070	0.663	ND	ND	0.585	0.489 J	N/A	N/A	N/A	ND
Pyrene	N/E	N/E	N/A	N/A	N/A	N/A	N/A	ND	3.740	3.680	ND	ND	0.526	0.512 J	N/A	N/A	N/A	ND
PCBs																		
PCB-1254	10	1	N/A	ND	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	0.613	N/A	N/A	N/A	ND

NOTES:

1. Concentrations in mg/kg (parts per million equivalent)
2. Compounds listed only if present in at least one sample
3. ND - Compound not present above method detection limits
4. S1A - Sample location 1 collected at a 6-12 inch depth
5. SSB-47 and S1B - Sample location 1 collected at a 2-3 feet depth
6. Background level of elements in soils, Criteria For Contaminated Soil/Sediment Cleanup, J. Fitchko, 1989
7. Michigan Background level of elements in soils, Waste Management Division, Michigan Dept. of Natural Resources, 12/21/87.
8. N/E - Not established
9. N/A - Not available
10. J - This result is a quantitative estimate. See text for clarification

SSB-51, S3B and S5B contained the highest levels of PCBs detected (2.15 mg/kg, 2.36 mg/kg and 8.19 mg/kg, respectively). The EPA cleanup recommended guideline for PCBs is 10 mg/kg.

2.4.3 Soil Boring/Monitor Well Installation

Following an evaluation of the data obtained during the qualitative screening and shallow soil sampling, a soil boring/monitor well installation program was implemented. Thirty-seven exploratory soil borings were drilled at the Site, under ERM oversight, in the locations illustrated in Figure 2-6. Details of the investigation are presented in Appendix C. Geologic logs were developed for each boring and are included in Appendix D.

Field screening results of the soil boring samples collected are presented in Table 2-3. Analytical results for the exploratory boring soil samples, submitted for analysis are summarized in Table 2-8. Laboratory data sheets are included in Appendix F. Chain-of-Custody forms are presented in Appendix G. Analytical parameters are only listed in Table 2-8 if detected in at least one soil sample.

The analytical results indicate elevated levels of metals in ten soil samples, MW-2 (2-4 ft); MW-2 (6-7 ft); MW-3 (4-6 ft); DB-1 (2-4 ft); DB-2 (0-2 ft); DB-2 (3-5 ft); DB-2 (5.5-7.5 ft); DB-2 (8-10 ft); DB-3 (0-2 ft); and DB-24 (3-5 ft). Sample MW-2 (2-4 ft) contained elevated concentrations of arsenic, cadmium, copper, lead, nickel, silver, and zinc, with the lead and zinc levels two orders of magnitude higher than background. Sample DB-3 (0-2 ft) contained elevated concentrations of lead levels one order of magnitude higher than background. The other samples contained elevated levels of lead, mercury, and/or zinc.

All but four of the forty-one samples analyzed for volatiles contained detectable levels of at least one VOC, with 1,2-dichloroethane (1,2-DCA) and 1,2-dichloropropane (1,2-DCP) being the most common VOCs detected. Most of the concentrations were low. However, seven samples MW-2 (2-4 ft), MW-6 (10-12 ft), DB-2 (8-10 ft), DB-2 (10.5-12.5 ft), DB-19 (5.5-7.5 ft), DB-25 (13-15 ft), and DB-28 (12-14 ft) contained elevated levels of one or more of the following compounds: 1,2-DCP, 1,2-DCA, and/or trichloroethene (TCE).

Ten of the twenty samples contained detectable concentrations of semi-volatile compounds, with samples from borings MW-2, MW-6, and DB-20 containing the highest concentrations detected in the soil analyzed. Most of the concentrations were low, with the exception of those three samples.

Table 2-8
Summary of Quantitative Analytical Results - Soil Borings
BASF Corporation - South Works
Wyandotte, Michigan

Analytical Parameter	U.S. Soil Background	MI Soil Background	MW-1 S-3 4-6 Ft	MW-1 S-6 10-12 Ft	MW-2 S-2 2-4 Ft	MW-2 S-4 6-7 Ft	MW-3 S-2 4-6 Ft	MW-3 S-5 9-11 Ft	MW-4 S-4 6-8 Ft	MW-4 S-9 18-19 Ft	MW-5 S-3 4-6 Ft	MW-6 S-2 2-4 Ft	MW-6 S-6 10-12 Ft	MW-7 S-2 2-4 Ft	MW-7 S-5 8-10 Ft
Moisture (%)			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Priority Pollutant Metals															
Iron (%)	N/E	N/E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	0.1 - 40	0.7 - 15.9	2.6	3.4	11.4	2	4.2	5.1	4.7	ND	ND	ND	4.5	8	3.2
Beryllium	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6	ND
Cadmium	N/E	1.0 - 1.55	ND	ND	11	1	ND	ND	ND	ND	1	ND	1	ND	ND
Chromium	50 - 170	3.0 - 24.5	13	16	10	6	19	20	27	6	5	5	17	10	16
Copper	2 - 200	4.5 - 82.5	10	16	64	16	23	19	18	5	ND	ND	18	27	13
Lead	2 - 200	6 - 56	ND	ND	3110	48	438	ND	ND	ND	ND	ND	ND	23	ND
Mercury	0.01 - 4.6	0.04 - 0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	10 - 40	2.5 - 16	14	18	46	20	19	23	31	6	ND	ND	21	19	16
Selenium	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	N/E	N/E	ND	ND	57	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	10 - 300	18 - 79	31	34	3240	98	109	49	60	9	7	8	49	34	36
Priority Pollutant Volatiles															
Benzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.012	0.73	0.013	0.28
Carbontetrachloride	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	ND	ND
Chloroform	N/E	N/E	ND	ND	ND	0.005	ND	ND	ND	ND	ND	0.012	9.1	ND	0.018
1,1-Dichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	N/E	N/E	ND	ND	0.088	0.098	0.006	0.01	0.011	0.014	0.031	0.16	190	0.04	0.23
1,2-Dichloroethene (total)	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	N/E	N/E	ND	ND	4.4	0.55	0.088	0.034	0.054	0.056	0.11	38	2900	0.15	0.54
Ethylbenzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.055
Methylene Chloride	N/E	N/E	0.026	0.15	0.035	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	N/E	N/E	ND	ND	ND	0.026	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	N/E	N/E	ND	ND	ND	0.012	ND	ND	ND	ND	ND	0.011	ND	ND	0.009
Trans-1,2-Dichloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	ND	ND
Trichloroethene	N/E	N/E	ND	ND	82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	N/E	N/E	ND	ND	ND	0.006	ND	ND	ND	ND	ND	ND	ND	ND	ND
Priority Pollutant Semi-Volatiles															
Acenaphthene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,4-Benzofluoranthene	N/E	N/E	ND	ND	0.34	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	N/E	N/E	ND	ND	0.34	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	N/E	N/E	ND	ND	0.34	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.37	63	ND	5.8
bis(2-Chloroisopropyl)ether	N/E	N/E	ND	ND	0.51	ND	0.40	ND	ND	ND	ND	21	1800	0.33	ND
Chrysene	N/E	N/E	ND	ND	0.47	ND	0.34	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.67	ND	ND
Di-n-butylphthalate	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.76	ND	ND
Fluoranthene	N/E	N/E	ND	ND	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno (1,2,3-cd)pyrene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Methylnaphthalene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	N/E	N/E	ND	ND	0.43	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	N/E	N/E	ND	ND	0.69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCBs															
PCB-1254	10	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTES:
1. Concentrations in mg/kg (parts per million equivalent)
2. Compounds listed only if present in at least one sample
3. ND - Compound not present above method detection limits
4. Background level of elements in soils, Criteria For Contaminated Soil/ Sediment Cleanup, J. Fitchko, 1989
5. Michigan Background level of elements in soils, Waste Management Div., Michigan Department of Natural Resources, 12/21/87.
6. N/E - Not established
7. N/A - Not available
8. This result is a quantitative estimate. See text for clarification
9. # - Data for semi-volatiles appears on qualitative data table 2-6

Table 2-8
Summary of Quan[illegible] Analytical Results - Soil Borings
BASF Corporation - South Works
Wyandotte, Michigan

Analytical Parameter	U.S. Soil Background	MI Soil Background	DB-1 2-4 Ft	DB-1 7-9 Ft	DB-1 9.5-11.5 Ft	DB-1 12-14 Ft	DB-1 14-15 Ft	DB-2 0-2 Ft	DB-2 3-5 Ft	DB-2 5.5-7.5 Ft	DB-2 8-10 Ft	DB-2 10.5-12.5 Ft	DB-3 0-2 Ft	DB-3 8-10 Ft	DB-3 12-13 Ft
Moisture (%)			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Priority Pollutant Metals															
Iron (%)	N/E	N/E	5.4	3.5	3.2	2.8	3.6	3.9	5.2	3.4	3.2	2.9	32.3	2.8	3.0
Arsenic	0.1 - 40	0.7 - 15.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium	N/E	N/E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	N/E	1.0 - 1.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	50 - 170	3.0 - 24.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	2 - 200	4.5 - 82.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	2 - 200	6 - 56	607.3	30.5	28.5	19.1	20.9	279.1	377.4	589.3	200.1	21.9	1418.9	14.2	22.7
Mercury	0.01 - 4.6	0.04 - 0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	10 - 40	2.5 - 16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	N/E	N/E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Silver	N/E	N/E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	10 - 300	18 - 79	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Priority Pollutant Volatiles															
Benzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbontetrachloride	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND
1,2-Dichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	N/E	N/E	ND	ND	ND	ND	ND	0.4	0.8	0.2	39.9	ND	ND	1.5	ND
1,2-Dichloropropane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzenne	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,2-Dichloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	N/E	N/E	ND	0.5	ND	ND	ND	ND	ND	ND	ND	216.2	ND	ND	ND
1,1,2-Trichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	N/E	N/E	4.4	.030	0.1	ND	0.02	2.7	3.5	1.5	200.4	7366.1	0.1	0.7	ND
Trichlorofluoromethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Priority Pollutant Semi-Volatiles															
Acenaphthene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Anthracene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Benzo(a)anthracene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Benzo(a)pyrene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
3,4-Benzofluoranthene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Benzo(g,h,i)perylene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Benzo(k)fluoranthene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
bis(2-Chloroethyl)ether	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
bis(2-Chloroisoproply)ether	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Chrysene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Dibenzo(a,h)anthracene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
1,2-Dichlorobenzene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Di-n-butylphthalate	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Fluoranthene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Fluorene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Hexachlorobenzene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Indeno (1,2,3-cd)pyrene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
1-Methylnaphthalene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
2-Methylnaphthalene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Naphthalene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Phenanthrene	N/E	N/E	#	#	#	#	#	#	#	#	#	#	#	#	#
Pyrene	N/E	N/E	#												
PCBs															
PCB-1254	10	1	3.32	ND	ND	ND	ND	ND	ND	ND	ND	2.15	ND	ND	ND

NOTES:

1. Concentrations in mg/kg (parts per million equivalent)
2. Compounds listed only if present in at least one sample
3. ND - Compound not present above method detection limits
4. Background level of elements in soils, Criteria For Contaminated Soil/ Sediment Cleanup, J. Fitchko, 1989
5. Michigan Background level of elements in soils, Waste Management Div., Michigan Department of Natural Resources, 12/21/87.
6. N/E - Not established
7. N/A - Not available
8. *This result is a quantitative estimate. See text for clarification.*
9. # - Data for semi-volatiles appears on qualitative data table 2-6

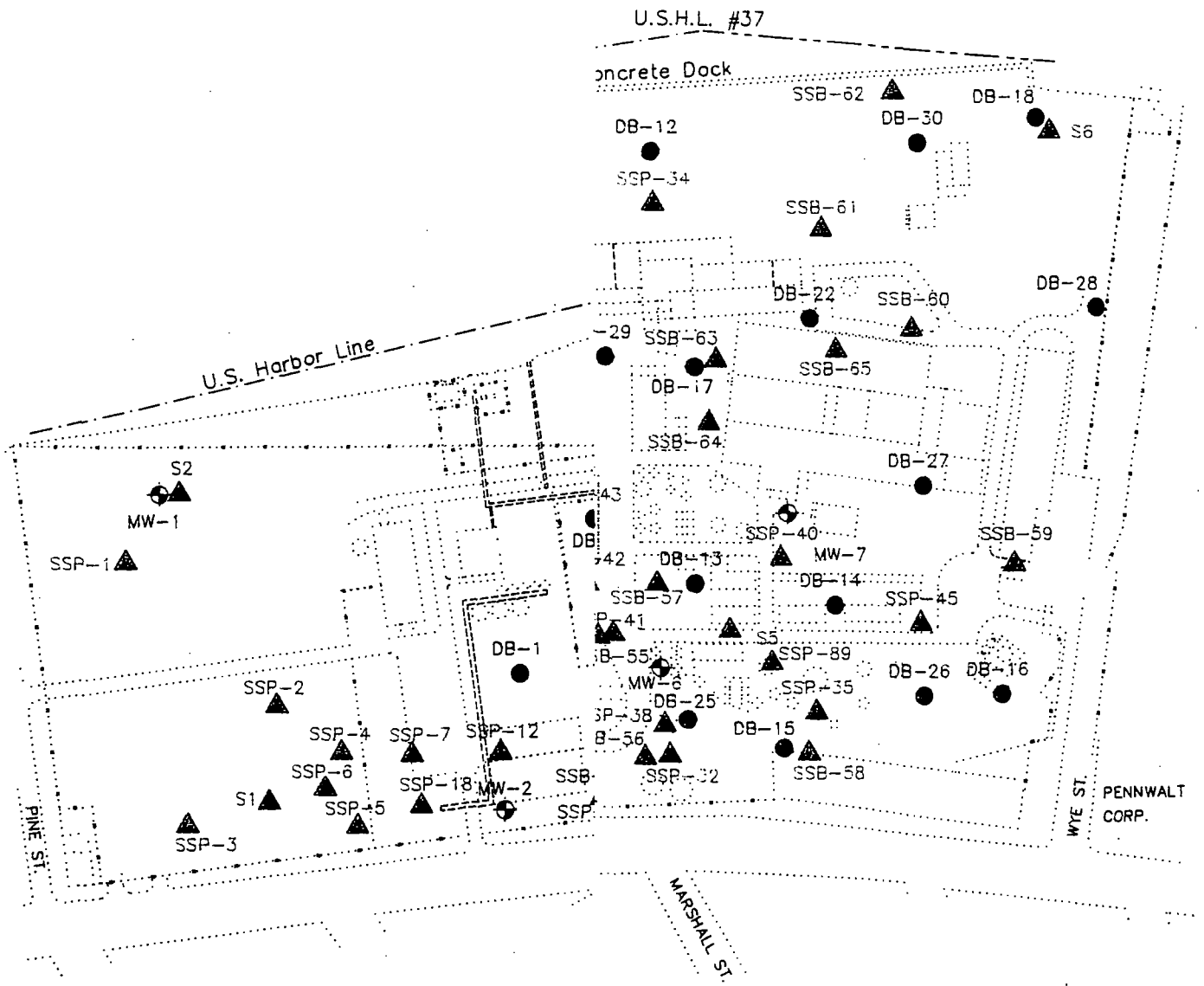
Table 2-8
Summary of Quantitative Analytical Results - Soil Borings
BASF Corporation - South Works
Wyandotte, Michigan

Analytical Parameter	U.S. Soil Background	MI Soil Background	DB-4 0-2 Ft	DB-4 10.5-12.5 Ft	DB-4 13-15 Ft	DB-19 5.5-7.5 Ft	DB-20 0-2 Ft	DB-21 8-10 Ft	DB-22 5.5-7.5 Ft	DB-23 8-10 Ft	DB-24 3-5 Ft	DB-25 13-15 Ft	DB-26 5.5-7.5 Ft	DB-27 11-13 Ft	DB-28 12-14 Ft	DB-29 3-5 Ft	DB-30 10.5-12.5 Ft
Moisture (%)			N/A	N/A	N/A	15	14.4	22.4	34.8	18.1	22.4	15.4	15.5	13.5	12.1	19.9	13.7
Priority Pollutant Metals																	
Iron (%)	N/E	N/E	ND	2.9	2.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	0.1 - 40	0.7 - 15.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium	N/E	N/E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	N/E	1.0 - 1.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	50 - 170	3.0 - 24.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	2 - 200	4.5 - 82.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	2 - 200	6 - 56	ND	10.2	12.8	N/A	53 J	N/A	8.3 J	N/A	N/A	8.2 J	N/A	7.1 J	5.1 J	N/A	N/A
Mercury	0.01 - 4.6	0.04 - 0.50	ND	ND	ND	N/A	0.81	N/A	ND	ND	11.7	ND	N/A	ND	ND	ND	0.97
Nickel	10 - 40	2.5 - 16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	N/E	N/E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Silver	N/E	N/E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	10 - 300	18 - 79	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Priority Pollutant Volatiles																	
Benzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.008	ND	ND	ND
Carbontetrachloride	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.071	ND	ND
Chlorobenzene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.78	ND	ND	ND	0.012	ND
Chloroform	N/E	N/E	ND	ND	ND	0.988	ND	ND	ND	ND	0.052	0.827	ND	0.021	92.2	ND	ND
1,1-Dichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.009	ND	ND
1,1-Dichloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	N/E	N/E	ND	ND	ND	ND	ND	0.013	0.032	ND	0.076	75.6	0.006	0.208	20.5	ND	ND
1,2-Dichlorethene (total)	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	N/E	N/E	ND	ND	ND	20	1.99	0.089	0.135	0.011	0.516	898	0.051	0.497	11.4	ND	ND
Ethylbenzenne	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	N/E	N/E	ND	ND	ND	ND	0.008	ND	ND	ND	0.041	ND	ND	0.02	2.96	0.006	ND
Tetrachloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	0.009	ND	ND	ND	ND	ND	182	ND	ND
Toluene	N/E	N/E	ND	ND	ND	ND	0.007	ND	ND	ND	0.009	ND	ND	0.024	ND	ND	ND
Trans-1,2-Dichloroethene	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	N/E	N/E	ND	ND	2.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.98	ND	ND
Trichloroethene	N/E	N/E	ND	0.3	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.114	ND	ND
Trichlorofluoromethane	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	N/E	N/E	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Priority Pollutant Semi-Volatiles																	
Acenaphthene	N/E	N/E	#	#	#	ND	ND	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Anthracene	N/E	N/E	#	#	#	ND	ND	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Benzo(a)anthracene	N/E	N/E	#	#	#	ND	0.818	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Benzo(a)pyrene	N/E	N/E	#	#	#	ND	0.619	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
3,4-Benzofluoranthene	N/E	N/E	#	#	#	ND	0.666	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Benzo(g,h,i)perylene	N/E	N/E	#	#	#	ND	0.456	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Benzo(k)fluoranthene	N/E	N/E	#	#	#	ND	0.596	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
bis(2-Chloroethyl)ether	N/E	N/E	#	#	#	ND	ND	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
bis(2-Chloroisoproply)ether	N/E	N/E	#	#	#	ND	ND	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Chrysene	N/E	N/E	#	#	#	ND	0.783	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Dibenzo(a,h)anthracene	N/E	N/E	#	#	#	ND	ND	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
1,2-Dichlorobenzene	N/E	N/E	#	#	#	ND	ND	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Di-n-butylphthalate	N/E	N/E	#	#	#	ND	ND	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Fluoranthene	N/E	N/E	#	#	#	ND	1.29	N/A	0.46	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Fluorene	N/E	N/E	#	#	#	ND	ND	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Hexachlorobenzene	N/E	N/E	#	#	#	ND	ND	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
Indeno (1,2,3-cd)pyrene	N/E	N/E	#	#	#	ND	0.432	N/A	ND	N/A	N/A	N/A	ND	ND	ND	N/A	ND
1-Methylnaphthalene	N/E	N/E	#	#	#	ND	ND	N/A	0.705	N/A	N/A	N/A	ND	ND	ND	N/A	0.417
2-Methylnaphthalene	N/E	N/E	#	#	#	ND	ND	N/A	0.797	N/A	N/A	N/A	ND	ND	ND	N/A	0.545
Naphthalene	N/E	N/E	#	#	#	ND	ND	N/A	0.353	N/A	N/A	N/A	ND	ND	0.512	N/A	ND
Phenanthrene	N/E	N/E	#	#	#	ND	0.479	N/A	0.491	N/A	N/A	N/A	ND	ND	ND	N/A	0.533
Pyrene	N/E	N/E				ND	1.1	N/A	0.353	N/A	N/A	N/A	ND	ND	ND	N/A	0.417
PCBs																	
PCB-1254	10	1	ND	ND	ND	N/A	N/A	ND	ND	N/A	N/A	ND	N/A	ND	ND	N/A	ND

NOTES:

1. Concentrations in mg/kg (parts per million equivalent)
2. Compounds listed only if present in at least one sample
3. ND - Compound not present above method detection limits
4. Background level of elements in soils, Criteria For Contaminated Soil/ Sediment Cleanup, J. Fitchko, 1989
5. Michigan Background level of elements in soils, Waste Management Div., Michigan Department of Natural Resources, 12/21/87.
6. N/E - Not established
7. N/A - Not available
8. This result is a quantitative estimate. See text for clarification.
9. # - Data for semi-volatiles appears on qualitative data table 2-6

Figure 2-6
Approximate
Sample Location Maps
BASF Corporation - South Works
Wyandotte, Michigan



WO#	Drawn by / Date: T. Stevens 2.11.90	The ERM Group
160-22-00-01	Revised by / Date: C. Pomante 9.25.90	

PCBs, specifically PCB-1254, were present above the method detection limits in two of the exploratory boring soil samples: DB-1 (2-4 ft) at 3.32 mg/kg and DB-2 (10.5-12.5) at 2.15 mg/kg. Both are below the EPA cleanup recommended guideline for PCBs of 10 mg/kg.

2.4.4 Ground Water Sampling

Following monitor well installation and development, the new monitor wells were allowed to equilibrate for a period of approximately one week. Ground water samples were then obtained from each new well according to standard protocols described in Appendix C. Table 2-10 summarizes the depth to ground water measurements.

The analytical results indicate that general water quality parameters and metals are within acceptable water quality parameters (Table 2-9). No PCBs were detected above the method detection limit in the samples analyzed.

Volatile organic compounds were detected in MW-2, MW-4, MW-6 and MW-7. Specifically, the volatiles can be subdivided into two main categories: chlorinated ethene compounds (tetrachloroethene, trichloroethene, 1,2-dichloroethene, 1,1-dichloroethene, and vinyl chloride) and petroleum hydrocarbons (benzene, toluene, ethylbenzene and xylenes - BTEX). BTEX concentrations were detected in only MW-6 and MW-7, located in the old petroleum distillation area. The chlorinated ethene constituents were detected in MW-2, MW-4, MW-6 and MW-7. In addition to the volatile organic compounds detected, low level concentrations of semi-volatile organic compounds were also detected in MW-4, MW-5, MW-6, and MW-7.

2.5 Monitor Point Abandonment

At the request of BASF, eighteen damaged on-site monitor points were abandoned. Summary of abandoned monitor point construction data are presented in Table 2-11. Leaving the damaged wells in place would have created the potential for preferential migration of surface fluids to the subsurface. The approximate former locations of the abandoned wells are illustrated in Figure 2-7. The wells were abandoned using standard procedures described in Appendix C. During abandonment at monitor point P-25 elevated OVA readings were identified. A grab sample of the soil was submitted for laboratory analysis (sample BWA-25).

Table 2-9
Summary Of Quantitative Analytical Results - Ground Water Sampling
BASF Corporation - South Works
Wyandotte, Michigan

PARAMETER	MCL	MW-1	MW-2	MW-3	dup MW-3B	MW-4	MW-5
Inorganics							
Antimony	N/A	ND (0.2)	NA	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)
Arsenic	0.05	ND (0.01)	NA	ND (0.01)	ND (0.01)	0.216	0.073
Beryllium	N/A	0.007	NA	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Calcium	N/A	812	NA	133	NA	127.0	207
Chromium	0.05	0.42	NA	0.18	0.16	0.20	0.05
Copper	1.3	0.53	NA	0.10	0.09	ND (0.05)	ND (0.05)
Iron	0.3	63.8	NA	18.9	NA	11.0	10.0
Lead	0.05	0.4	NA	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Magnesium	N/A	152	NA	10.9	NA	12.5	6.0
Manganese	0.3	2.40	NA	0.68	NA	0.38	0.44
Mercury	0.002	0.001	NA	ND (0.0005)	ND (0.005)	0.0032	0.236
Nickel	P	0.79	NA	0.23	0.22	0.28	ND (0.05)
Potassium	N/A	5.2	NA	8.3	NA	6.4	50.2
Selenium	0.01	0.009	NA	0.008	ND (0.005)	0.009	ND (0.005)
Sodium	N/A	66.5	NA	1180	NA	10200	1340
Zinc	5	1.90	NA	0.41	0.41	0.07	1.50
Priority Pollutant Volatiles							
Benzene	0.005	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Chlorobenzene	0.1	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Chloroform	0.1	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	0.029	ND (0.005)
1,1-Dichloroethane	P	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
1,2-Dichloroethane	0.005	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
1,1-Dichloroethylene	0.007	ND (0.005)	0.009	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
trans-1,2-Dichloroethylene	P	ND (0.005)	0.14	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
1,2-Dichloropropane	P	ND (0.005)	0.017	ND (0.005)	ND (0.005)	0.052	ND (0.005)
Ethylbenzene	P	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Methylene chloride	P	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Tetrachloroethylene	P	ND (0.005)	0.013	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Toluene	P	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Trichloroethylene	0.005	ND (0.005)	2.5	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Vinyl chloride	0.002	ND (0.01)	2	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)
Priority Pollutant Semi-Volatiles							
Acenaphthene	N/A	ND (0.01)	NA	ND (0.01)	ND (0.01)	ND (0.02)	ND (0.01)
bis(2-Chloroethyl)ether	N/A	ND (0.01)	NA	ND (0.01)	ND (0.01)	ND (0.02)	ND (0.01)
bis(2-Chloroisopropyl)ether	N/A	ND (0.01)	NA	ND (0.01)	0.022	ND (0.02)	ND (0.01)
p-Chloro-m-cresol	N/A	ND (0.01)	NA	ND (0.01)	ND (0.01)	0.011	ND (0.01)
2-Chlorophenol	N/A	ND (0.01)	NA	ND (0.01)	ND (0.01)	ND (0.02)	ND (0.01)
o-Dichlorobenzene	0.075	ND (0.01)	NA	ND (0.01)	ND (0.01)	ND (0.02)	ND (0.01)
p-Dichlorobenzene	P	ND (0.01)	NA	ND (0.01)	ND (0.01)	ND (0.02)	ND (0.01)
p-Nitrophenol	N/A	ND (0.01)	NA	ND (0.01)	ND (0.01)	ND (0.02)	ND (0.01)
N-Nitrosodi-n-propylamine	N/A	ND (0.01)	NA	ND (0.01)	ND (0.01)	ND (0.02)	ND (0.01)
Pentachlorophenol	N/A	ND (0.05)	NA	ND (0.05)	ND (0.05)	ND (0.1)	ND (0.05)
Phenol	P	ND (0.01)	NA	ND (0.01)	ND (0.01)	0.067	0.01
Pyrene	N/A	ND (0.01)	NA	ND (0.01)	ND (0.01)	ND (0.02)	ND (0.01)
1,2,4-Trichlorobenzene	0.009	ND (0.01)	NA	ND (0.01)	ND (0.01)	ND (0.02)	ND (0.01)
PCBs							
None Detected							

NOTES:

1. Concentrations in mg/l (parts per million equivalent).
2. Compounds listed only if present in at least one sample.
3. ND (#) - Compound not present above method detection limits, given in parentheses.
4. N/A - Not available
5. NA - Not analyzed
6. U.S. EPA Drinking Water Regulations (Spring 1989) National Primary Drinking Water Standards Maximum Contaminate Level (MCL).
7. P - Values proposed but not promulgated.
8. B - Duplicate
9. WW-1 - Water used for site decontamination of equipment.

Table 2-9
Summary Of Quantitative Analytical Results - Ground Water Sampling
BASF Corporation - South Works
Wyandotte, Michigan

PARAMETER	MCL	MW-6	MW-7	MCL	WW-1
Inorganics					
Antimony	N/A	ND (0.2)	ND (0.2)	N/A	NA
Arsenic	0.05	0.064	0.035	0.05	NA
Beryllium	N/A	ND (0.005)	ND (0.005)	N/A	NA
Calcium	N/A	814	797	N/A	NA
Chromium	0.05	0.06	0.14	0.05	NA
Copper	1.3	0.05	0.24	1.3	NA
Iron	0.3	102	45.2	0.3	NA
Lead	0.05	0.2	0.4	0.05	NA
Magnesium	N/A	44.9	57.8	N/A	NA
Manganese	0.3	3.41	1.22	0.3	NA
Mercury	0.002	0.0012	0.0024	0.002	NA
Nickel	P	0.05	0.24	P	NA
Potassium	N/A	17.2	18.8	N/A	NA
Selenium	0.01	ND (0.005)	ND (0.005)	0.01	NA
Sodium	N/A	198	169	N/A	NA
Zinc	5	0.88	2.70	5	NA
Priority Pollutant Volatiles					
Benzene	0.005	0.42	0.047	0.005	ND (0.005)
Chlorobenzene	0.1	0.28	ND (0.005)	0.1	ND (0.005)
Chloroform	0.1	0.97	0.008	0.1	ND (0.005)
1,1-Dichloroethane	P	0.08	ND (0.005)	P	ND (0.005)
1,2-Dichloroethane	0.005	2.1	ND (0.005)	0.005	ND (0.005)
1,1-Dichloroethylene	0.007	ND (0.05)	ND (0.005)	0.007	ND (0.005)
trans-1,2-Dichloroethylene	P	ND (0.05)	ND (0.005)	P	ND (0.005)
1,2-Dichloropropane	P	110	0.014	P	ND (0.005)
Ethylbenzene	P	ND (0.05)	0.028	P	ND (0.005)
Methylene chloride	P	0.092	ND (0.005)	P	ND (0.01)
Tetrachloroethylene	P	ND (0.05)	ND (0.005)	P	ND (0.005)
Toluene	P	0.067	ND (0.005)	P	ND (0.005)
Trichloroethylene	0.005	ND (0.05)	ND (0.005)	0.005	ND (0.005)
Vinyl chloride	0.002	ND (0.1)	ND (0.01)	0.002	ND (0.01)
Priority Pollutant Semi-Volatiles					
Acenaphthene	N/A	ND (0.02)	ND (0.02)	N/A	NA
bis(2-Chloroethyl)ether	N/A	2.3	0.21	N/A	NA
bis(2-Chloroisopropyl)ether	N/A	160	0.58	N/A	NA
p-Chloro-m-cresol	N/A	ND (0.02)	0.029	N/A	NA
2-Chlorophenol	N/A	ND (0.02)	ND (0.02)	N/A	NA
o-Dichlorobenzene	0.075	0.043	ND (0.02)	0.075	NA
p-Dichlorobenzene	P	0.057	ND (0.02)	P	NA
p-Nitrophenol	N/A	ND (0.02)	ND (0.02)	N/A	NA
N-Nitrosodi-n-propylamine	N/A	ND (0.02)	ND (0.02)	N/A	NA
Pentachlorophenol	N/A	ND (0.1)	ND (0.1)	N/A	NA
Phenol	P	ND (0.02)	ND (0.02)	P	NA
Pyrene	N/A	ND (0.02)	0.023	N/A	NA
1,2,4-Trichlorobenzene	0.009	ND (0.02)	ND (0.02)	0.009	NA
PCBs					
None Detected					

NOTES:

1. Concentrations in mg/l (parts per million equivalent).
2. Compounds listed only if present in at least one sample.
3. ND (#) - Compound not present above method detection limits, given in parentheses.
4. N/A - Not available
5. NA - Not analyzed
6. U.S. EPA Drinking Water Regulations (Spring 1989) National Primary Drinking Water Standards Maximum Contaminate Level (MCL).
7. P - Values proposed but not promulgated.
8. B - Duplicate
9. WW-1 - Water used for site decontamination of equipment.

Table 2-10
Ground Water Measurements
November-89
BASF Corporation - South Works
Wyandotte, Michigan

Monitor Well	Depth to Water (in feet below TOC)
MW-1	7.27
MW-2	6.23
MW-3	7.71
MW-4	11.31
MW-5	4.38
MW-6	5.05
MW-7	4.33

TOC - Top of Casing
Measurements collected on 30 November 1989.

Table 2-11
Summary of Abandoned Monitor
Point Construction Data
BASF Corporation - South Works
Wyandotte, Michigan

Identification	Total Depth (ft)	Materials of Construction
P-2	9	SCH 40 PVC
P-3	8	SCH 40 PVC
P-5	9	SCH 40 PVC
P-6	9	SCH 40 PVC
P-7	7	SCH 40 PVC
P-13	10	SCH 40 PVC
P-14	14	SCH 40 PVC
P-15	9	SCH 40 PVC
P-16	9	SCH 40 PVC
P-18	14	SCH 40 PVC
P-21	8	SCH 40 PVC
P-23	10	SCH 40 PVC
P-25	25	SCH 40 PVC
P-26	23	SCH 40 PVC
P-27	12	SCH 40 PVC
DNR-19	5	GALV. & SS
UN-1	18	SCH 40 PVC
UN-2	18	SCH 40 PVC

NOTES:
1. "P" - monitor point installed by S.S. Papadopulos & Associates, Inc.
2. "DNR" - monitor point installed by the MDNR
3. "UN" - monitor point of unknown origin
4. "SCH 40 PVC" - polyvinyl chloride well screen and casing
5. "GALV & SS" - galvanized steel riser and stainless steel screen

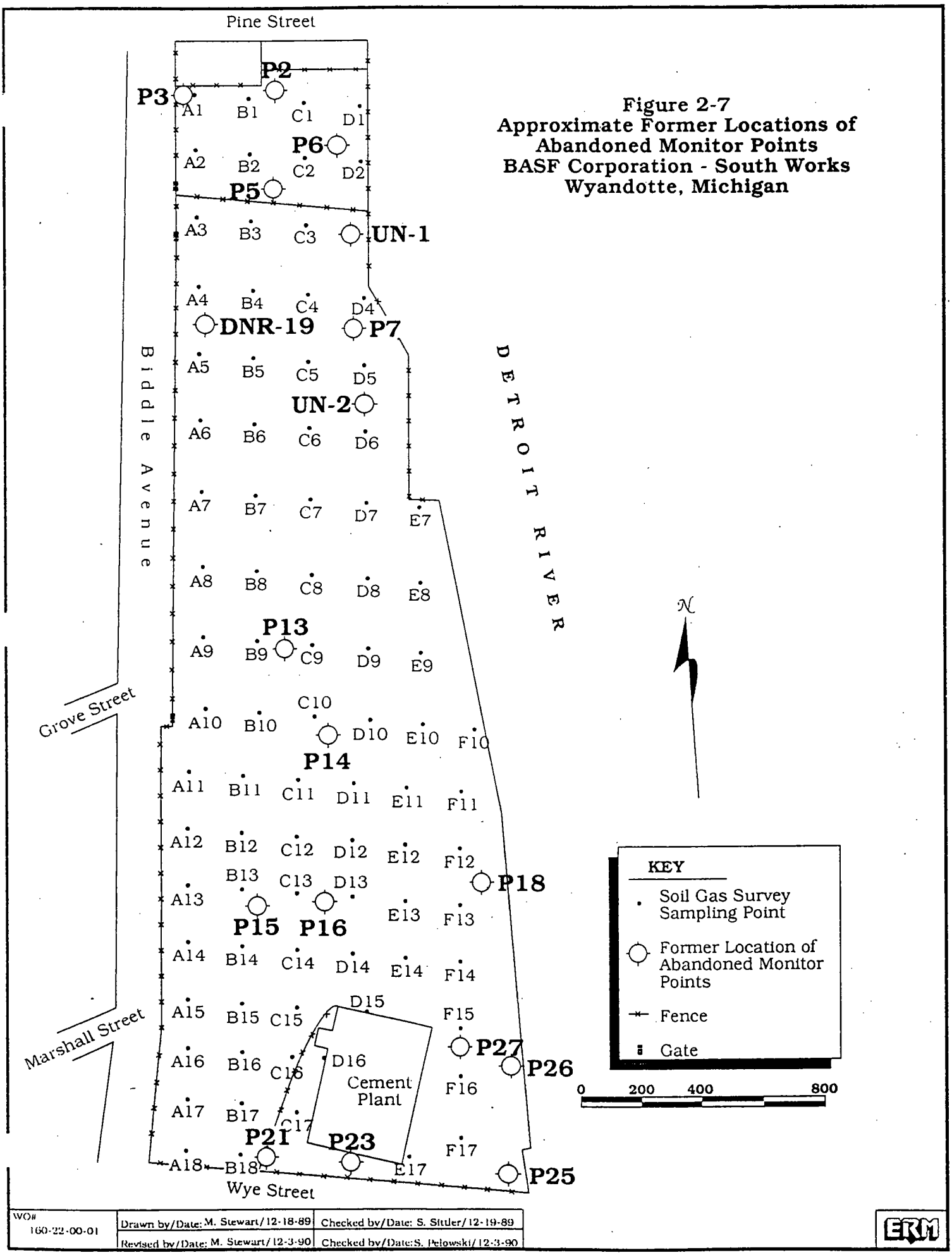


Figure 2-7
Approximate Former Locations of Abandoned Monitor Points
BASF Corporation - South Works
Wyandotte, Michigan

WO#		
160-22-00-01	Drawn by/Date: M. Stewart/12-18-89	Checked by/Date: S. Sitler/12-19-89
	Revised by/Date: M. Stewart/12-3-90	Checked by/Date: S. Pelowski/12-3-90

ERM

SECTION 3
RISK ASSESSMENT

3.1 Approach

EPA has proposed guidelines for the preparation of Risk Assessments (RAs) in several documents including the Endangerment Assessment Handbook (EPA, 1985), Superfund Public Health Evaluation Manual - SPHEM (EPA, 1986a), Superfund Exposure Assessment Manual (EPA, 1988a), Toxicology Handbook (EPA 1986b), Exposure Factors Handbook (EPA, 1989a), and Risk Assessment Guidance for Superfund: Human Health Evaluation Manual - Part A (EPA, 1989b). In addition, the Michigan Department of Natural Resources (MDNR 1990) has draft guidelines for conducting risk assessments. The detailed methodology used in this RA is derived from EPA and MDNR sources and is presented in Appendix I. The following discussion is not intended to be a comprehensive guide for preparing risk assessments, but is offered as a brief summary of the main components of a standard RA.

Four evaluations or steps are used in preparing an RA:

- Identification of compounds, which are selected to represent the majority (e.g., 90 to 95 percent) of carcinogenic risk and noncarcinogenic hazard at the Site;
- Toxicity evaluation of the potential carcinogenicity and noncarcinogenic effects of site-specific compounds;
- Exposure evaluation, which includes the calculation of intakes to potentially exposed populations; and
- Risk characterization, which includes the calculation of risks or hazards under current conditions caused by exposure to each compound and comparison of actual concentrations detected at a site with applicable standards.

The general approach for each of these evaluations is presented below. Two separate risk assessments were prepared for the Site: Current Site Conditions and Future Land Use.

Current Risk

Standard risk assessment methodology, as presented graphically in Figure 3-1, was employed to establish the current risk associated with the South Works Site. Ground water uses were not evaluated under current Site conditions because a Consent Decree with MDNR is enforced and ground water recovery has been underway since 1985. The remainder of Section 3 discusses the risk assessment specific for current site conditions.

Future Risk

The results of the risk assessment process (Figure 3-2) were modified significantly to calculate the risk for future land uses. Different exposure assumptions were applied to each of the land use groups. The risk assessment for future land uses is discussed in Section 5.

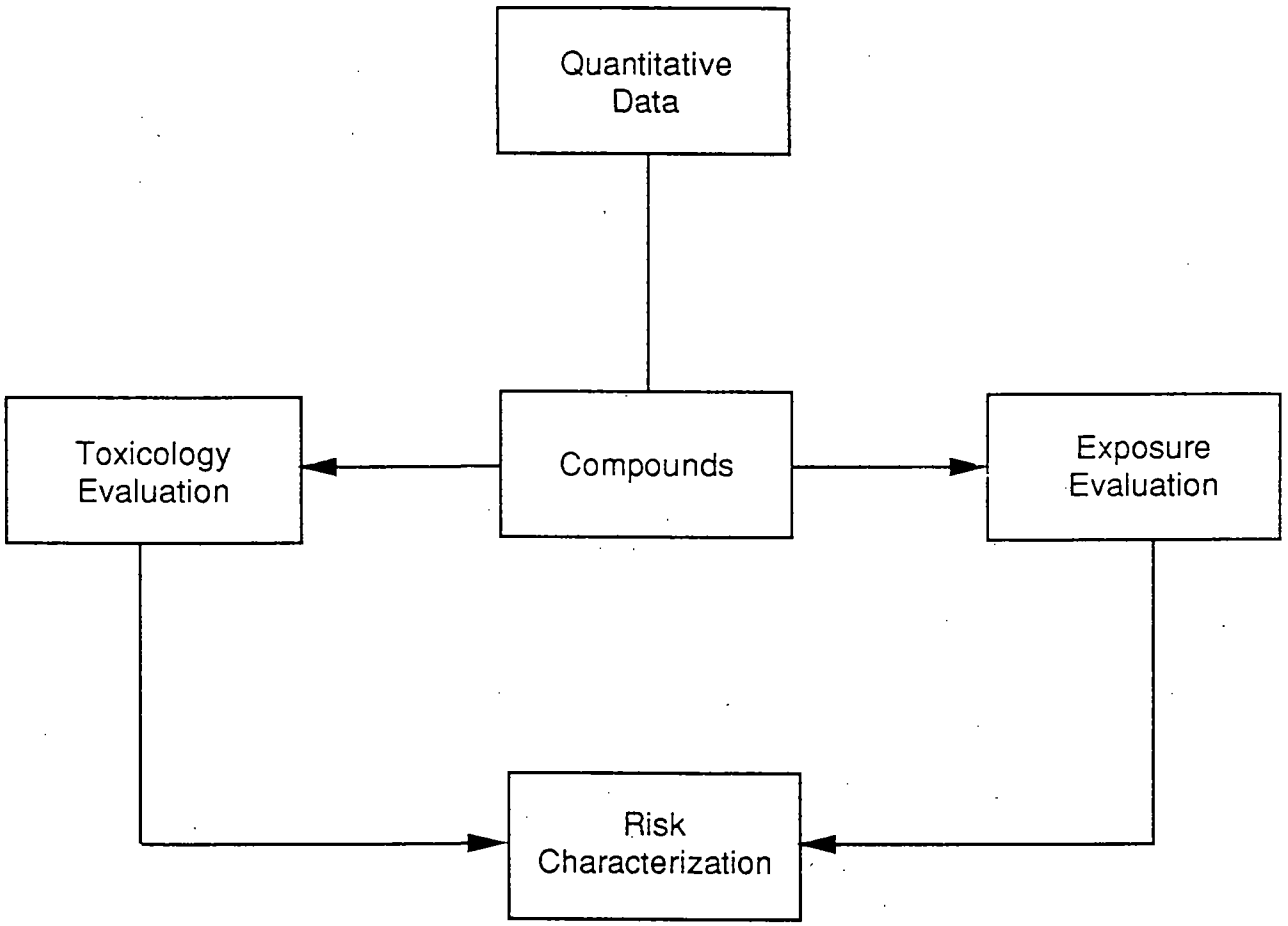
3.2 Compounds Evaluated at the BASF South Works Site

3.2.1 Approach

The approach used in selecting compounds specific for a site is detailed in Appendix I. Compounds selected to represent current (and also future) site risks must meet one or more of the following criteria. The compounds must be:

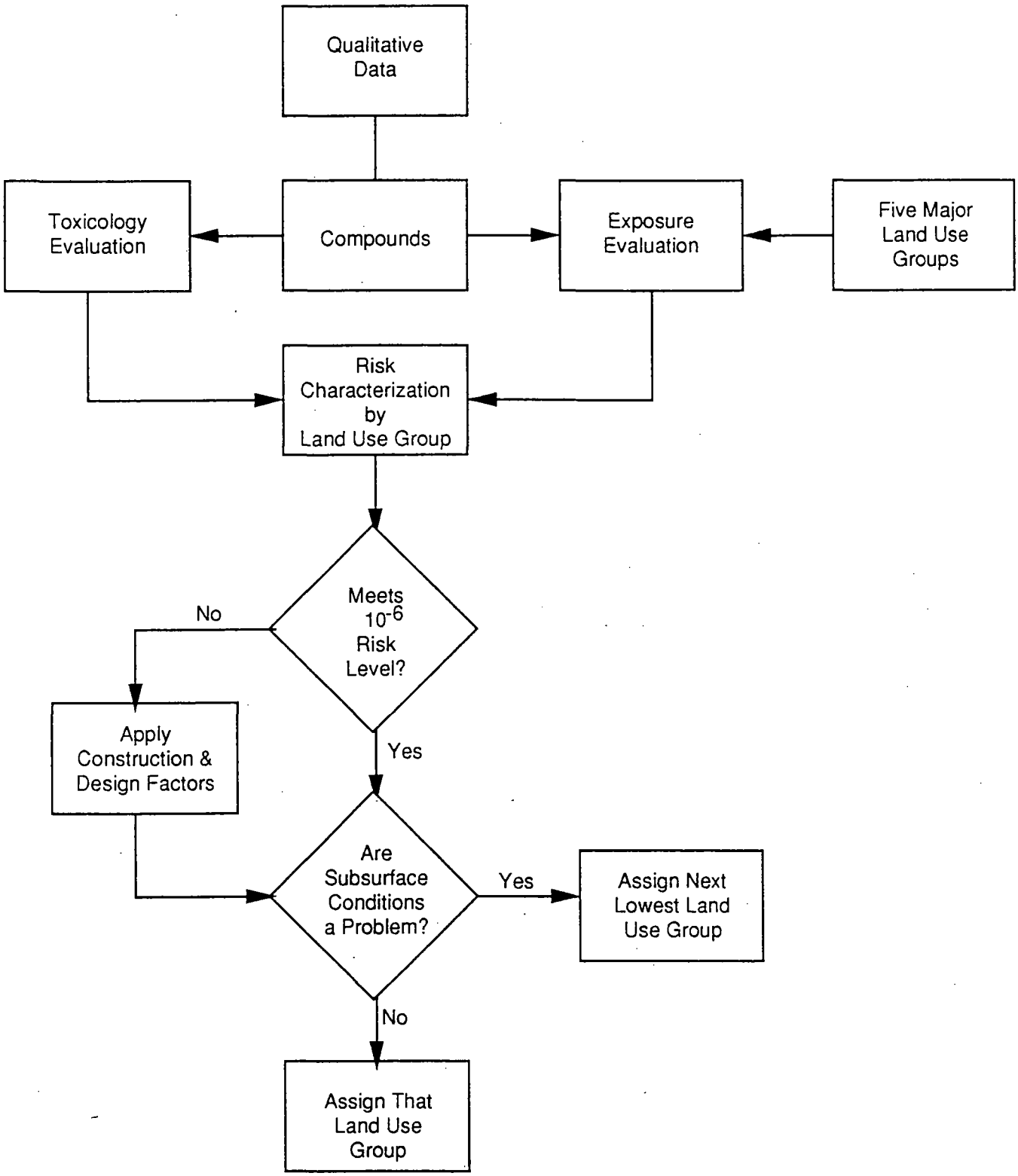
- Positively detected in at least one sample in a given medium including compounds with no data qualifiers attached and compounds with data qualifiers attached that indicate known identities but unknown concentrations (e.g., "J" - qualified data);
- Detected at levels significantly higher than levels of the same compound in the associated blank samples;
- Detected at levels significantly higher than naturally occurring levels of the same compounds;
- Only tentatively identified, but associated with the Site based on historical information or positively confirmed by analytical procedures; and/or
- Transformation products of compounds demonstrated to be present.

Figure 3-1
Baseline Risk Assessment Process
BASF Corporation - South Works
Wyandotte, Michigan



WO#	Drawn by / Date: CAP/12-4-90		The ERM Group
16022.01.01	Revised by / Date:		

Figure 3-2
Risk Assessment Process for Future Land Use
BASF Corporation - South Works
Wyandotte, Michigan



WO#	Drawn by / Date: CAP/12-4-90		The ERM Group
16022.01.01	Revised by / Date:		

Additionally, compounds that were not detected in samples for a given medium (e.g., non-detects), but which may be present at a site based on historical information, should be included as compounds for evaluation. These compounds are evaluated using the detection limit.

Two procedures are essential in the selection of compounds for a site. The first procedure is the proper collection, analysis, and quality assurance of the data. The second procedure is the accurate calculation of representative or average concentrations of compounds in the media.

Quality Assurance/Quality Control

Only data that has been properly collected, analyzed, and quality controlled is suitable for a risk assessment. If this procedure is not employed, then the risks may be negatively biased.

All data used in the selection of compounds were subjected to a comprehensive quality assurance and quality control (QA/QC) review. The QA/QC reports are provided in Appendix H.

Representative Concentration

The representative concentration of a compound per medium is the arithmetic average with one modification. The arithmetic average is modified to include one-half of the analytical detection limit instead of zero for those concentrations entered on the summary data tables as blanks or ND (non-detectable).

3.2.2 Compound Selection

The compounds identified in the Site Investigation are a diverse group with varying toxicological properties. The compounds differ widely in concentration and occurrence throughout the Site. Thus, some compounds represent a greater potential risk to human health and/or the environment than others because of differences in toxicity, ability of the compound to migrate to receptors, and the likelihood of exposure. It is neither necessary nor practical to evaluate all compounds in terms of transport, exposure, and attendant health or environmental risk in order to effectively address risk.

The following criteria were used as the basis for selecting specific compounds for the Site:

- Only quantitative data collected during the Site Investigation were used. These data are summarized in Table 3-1, discussed in Section 2.4 of this report, and presented in Appendix F. The locations of the samples used in this quantitative RA are presented in Figure 3-3.
- This process was limited to those compounds listed in Appendix F.
- The concentrations of inorganic and organic compounds in all samples were compared to ranges in appropriate background samples, where applicable. Inorganic concentrations in soil that fell within background ranges were considered background levels and disregarded. Those inorganics detected at concentrations above background soil levels or in other applicable media for which background levels were not available were considered in the selection process.
- Organic compounds were removed from consideration when they were detected infrequently, found at trace levels, or both; or when they were only found at concentrations near the detection limit.
- Compounds responsible for 90-95 percent of the potential risks were selected.

3.2.3 Discussion of Classification of Compounds

A general discussion of the compounds representative of each chemical class detected during the Site Investigation is included to emphasize the need to select one or more compounds to represent a class.

The volatile organics are comprised, in general, of halogenated, saturated and unsaturated, aliphatic and selected aromatic compounds. These compounds are generally soluble in water and have relatively high volatility rates. They are not readily adsorbed onto soils/sediments or suspended particles and are therefore available for transport to ground water through leaching processes, to surface water through runoff, and to the atmosphere through volatilization from soils or surface water, or both. Volatile organic compounds were detected in soil samples and were related to past operations. Specific compounds detected and used to represent this class were toluene, benzene, trichloroethene, and 1,2-dichloropropane.

Table 3-1
Samples Used In Quantitative Risk Assessment
BASF Corporation - South Works
Wyandotte, Michigan

Area			2	2	1			2	2	2	2			3	3	3		
Matrix Type	MI Soil Back-ground	Laboratory Detection Limits	Surface S2A	Surface S2B	Surface SSP-1	AVE	MAX	Surface S1A	Surface S1B	Surface SSP-3	Surface SSP-5	AVE	MAX	Surface MW-2 2-4 ft.	Surface SSP-7	Subsurf. DB-1 3-4 ft.	AVE	MAX
Date Sampled			10/89	10/89	3/90			10/89	10/89	3/90	3/90			10/89	3/90	3/90		
Inorganics																		
Arsenic	0.7-15.9	1	6.7*	4.5*	13.5*	-	-	11.8*	18	148		55.7	148	11.4*	23.8		8.6	23.8
Beryllium	None	0.5			N/A					N/A	N/A				N/A			
Cadmium	1.0-1.55	1			N/A					N/A	N/A			11	N/A			
Chromium	3.0-24.5	1	21*	17*	N/A			21*	10*	N/A	N/A			10*	N/A			
Copper	4.5-82.5	5	17*	31*	N/A			23*	16*	N/A	N/A			64*	N/A			
Lead	6-56	0.2	12*	110	47.6*	36.8	110	77	41*	95.6	1020	298	1020	3110	845	607	587	3110
Mercury	0.04-0.50	0.25			4.8	1.77	4.8	0.34*	0.26*	4.6		1.34	4.6					
Nickel	2.5-16	5	24	14*	N/A			19	6*	N/A	N/A			46	N/A			
Selenium	None	0.5			N/A				1.3	N/A	N/A				N/A			
Silver	None	1			N/A					N/A	N/A			57	N/A			
Zinc	18-79	1	54*	86	N/A			88	25*	N/A	N/A			31*	N/A			
Priority Pollutant Volatiles																		
Benzene	None	0.005																
Carbon Tetrachloride																		
Chlorobenzene																		
Chloroform	None	0.005																
1,2-Dichloroethane	None	0.005												0.088	0.042		0.044	0.088
1,2-Dichloroethene	None	0.005																
1,2-Dichloropropane	None	0.005								18.9	Q 0.2 Q	4.78	18.9	4.4	1.115 Q		1.84	4.4
Ethylbenzene	None	0.005																
Methylene Chloride	None	0.005			N/A					N/A	N/A			0.035	N/A		0.0188	0.035
Tetrachloroethylene	None	0.005																
Toluene	None	0.005						0.006	0.014		0.2	0.056	0.2			0.473 B	0.159	0.473
1,1,2-Trichloroethane	None	0.005																
Trichloroethylene	None	0.005			0.6	Q 0.22	0.6		0.026	112.2	Q 0.2 Q	28.1	112.2	82	1.4 Q	0.033 B	27.8	82
Trichlorofluoromethane	None	0.01	0.012	0.006	N/A	0.008	0.012	0.006	0.009	N/A	N/A	0.008	0.009		N/A			
Vinyl Chloride																		
Priority Pollutant Semivolatiles																		
Acenaphthene	None	0.33							0.53			0.26	0.53		0.99	27.57		
Anthracene	None	0.33							1.5		0.2 Q	0.51	1.5		0.19	26.15		
Benzo(a)anthracene	None	0.33						0.93	2.9			1.04	2.9					
Benzo(a)pyrene	None	0.33						0.77	1.9			0.75	1.9					
3,4-Benzofluoranthene	None	0.33			N/A			0.7	2.9	N/A	N/A	1.8	2.9	0.34	N/A			
Benzo(g,h,i)perylene	None	0.33						0.93	1.4			0.67	1.4	0.34			0.22	0.34
Benzo(b or k)fluoranthene	None	0.33												0.34			0.22	0.34
bis(2-Chloroethyl)ether	None	0.33													N/A			
bis(2-Chloroisopropyl)ether	None	0.33			N/A					N/A	N/A			0.51			0.28	0.51
Chrysene	None	0.33						1.0	3.3			1.15	3.3	0.47			0.27	0.47
Dibenzo(a,h)anthracene	None	0.33																
Fluoranthene	None	0.33						1.4	5.7		0.1 Q	1.84	5.7	0.65		18.18		
Fluorene	None	0.33							0.83			0.33	0.83			8.33		
Indeno(1,2,3-cd)pyrene	None	0.33						0.37				0.21	0.37					
1-Methylnaphthalene																		
2-Methylnaphthalene																		
Naphthalene	None	0.33							3.0	3.69		1.76	3.69		73.5			
Phenanthrene	None	0.33						0.7	5.3			1.58	5.3	0.43				
Pyrene	None	0.33						2.0	9.0			2.83	9.0	0.69				
PCBs																		
PCB-1254	None	0.32																

Blanks indicate not detected.
N/A - Not analyzed.
*Below Michigan soil background level. Thus, not included in average calculations.
Surface indicates shallow sampling.
Subsurface means that a drill rig was used to collect split spoon samples.
(L) - Laboratory result; other results from FAST unit.

Table 3-1
Samples Used in Quantitative Risk Assessment
BASF Corporation - South Works
Wyandotte, Michigan

Area			4						5													
Matrix Type	MI Soil Background	Laboratory Detection Limits	Surface SSP-9	Surface SSP-46	Surface SSP-47	Surface SSP-10	AVE	MAX	Surface S3A	Surface S3B	Surface S8A	Surface S8B	Surface SSP-11	Surface SSP-13	Surface SSP-15	Subsurf. DB-2 0-2 ft.	Subsurf. DB-2 2-5 ft.	Subsurf. DB-3 0-2 ft.	AVE	MAX
Date Sampled			3/90	9/90	9/90	3/1/71			10/89	10/89	10/89	10/89	3/90	3/90	3/90	3/90	3/90	3/90		
Inorganics																				
Arsenic	0.7-15.9	1	29	N/A	N/A	N/A	8	29	4.6*	32.8	7.0*	2.6*			48.5	4.3*	15.4*		8.93	48.5
Beryllium	None	0.5	N/A	N/A	N/A	N/A							N/A	N/A	N/A	N/A	N/A	N/A		
Cadmium	1.0-1.55	1	N/A	N/A	N/A	N/A							N/A	N/A	N/A	N/A	N/A	N/A		
Chromium	3.0-24.5	1	N/A	N/A	N/A	N/A			49	15*	56	12*	N/A	N/A	N/A	N/A	N/A	N/A		
Copper	4.5-82.5	5	N/A	N/A	N/A	N/A			44*	66*	36*	10*	N/A	N/A	N/A	N/A	N/A	N/A		
Lead	6-56	0.2	379	N/A	N/A		94.9	379	59	184	51*	22*	2830	232	393	279	377	1420	577	2830
Mercury	0.04-0.50	0.25		N/A	N/A					3.85			5.9	8.2	6.9			15.5	4.16	15.5
Nickel	2.5-16	5	N/A	N/A	N/A	N/A			26	206	42	11*	N/A	N/A	N/A	N/A	N/A	N/A		
Selenium	None	0.5	N/A	N/A	N/A	N/A							N/A	N/A	N/A	N/A	N/A	N/A		
Silver	None	1	N/A	N/A	N/A	N/A							N/A	N/A	N/A	N/A	N/A	N/A		
Zinc	18-79	1	N/A	N/A	N/A	N/A			111	87	103	20*	N/A	N/A	N/A	N/A	N/A	N/A		
Priority Pollutant Volatiles																				
Benzene	None	0.005																		
Carbon Tetrachloride																				
Chlorobenzene																				
Chloroform	None	0.005																		
1,2-Dichloroethane	None	0.005	6.801				1.7	6.801					0.086	0.158	0.057	0.363	0.754		0.143	0.754
1,2-Dichloroethene	None	0.005		0.008		0.12	0.033	0.12								0.4	0.8		0.122	0.8
1,2-Dichloropropane	None	0.005			0.225		0.058	0.225		0.21				1.26 Q	0.846 Q				0.233	1.26
Ethylbenzene	None	0.005	0.109				0.029	0.109				0.008								
Methylene Chloride	None	0.005	N/A		0.011		0.005	0.011					N/A	N/A	N/A	N/A	N/A	N/A		
Tetrachloroethylene	None	0.005		0.227			0.058	0.227		0.14									0.016	0.14
Toluene	None	0.005	0.253 B		0.012		0.0675	0.253		0.005		0.01	0.134 B			0.458 B	0.584 B		0.120	0.584
1,1,2-Trichloroethane	None	0.005																		
Trichloroethylene	None	0.005	21.284	3.48	22.1	0.33	11.8	22.1					0.676	3.765 Q	1.586 Q	2.733	3.475		1.22	3.765
Trichlorofluoromethane	None	0.01	N/A									0.005	N/A	N/A	N/A	N/A	N/A	N/A		
Vinyl Chloride																				
Priority Pollutant Semivolatiles																				
Acenaphthene	None	0.33								0.2				9.92						
Anthracene	None	0.33	2.63				0.33						0.42	9.41			0.10 Q			
Benzo(a)anthracene	None	0.33			0.812		0.23	0.81		1.2				5.26					0.65	5.26
Benzo(a)pyrene	None	0.33	1.96		0.740		0.76	1.96	0.8	0.7			0.49	3.52	0.56		0.19		1.32	3.52
3,4-Benzofluoranthene	None	0.33	N/A						0.9	0.77			N/A	N/A	N/A	N/A	N/A	N/A		
Benzo(g,h,i)perylene	None	0.33			0.509		0.25	0.51												
Benzo(b or k)fluoranthene	None	0.33			1.528		0.50	1.52	0.77	0.78									0.283	0.78
bis(2-Chloroethyl)ether	None	0.33	N/A	N/A	N/A								N/A	N/A	N/A	N/A	N/A	N/A		
bis(2-Chloroisopropyl)ether	None	0.33		N/A	N/A					0.71									0.073	0.71
Chrysene	None	0.33			0.994		0.371	0.994	0.93	1.0									0.32	1.0
Dibenzo(a,h)anthracene	None	0.33								1.29									0.27	1.29
Fluoranthene	None	0.33	2.90		0.982				1.6	1.8			0.73	6.54	1.04	0.08 Q	0.14 Q	0.08 Q		
Fluorene	None	0.33	0.53							0.33				7.53						
Indeno(1,2,3-cd)pyrene	None	0.33			0.437		0.23	0.44						2.17						
1-Methylnaphthalene					2.06															
2-Methylnaphthalene					2.55															
Naphthalene	None	0.33			1.46					0.63		0.53						1.74 Q		
Phenanthrene	None	0.33			2.18				0.87	1.6		0.37								
Pyrene	None	0.33			1.46				2.1	2.0										
PCBs																				
PCB-1254	None	0.32		N/A	N/A					2.36					20.11				2.5	20.1

Blanks indicate not detected.
N/A - Not analyzed.
*Below Michigan soil background level. Thus, not included in average calculations.
Surface indicates shallow sampling.
Subsurface means that a drill rig was used to collect split spoon samples.
(L) - Laboratory result; other results from FAST unit.

Table 3-1
Samples Used in Quantitative Risk Assessment
BASF Corporation - South Works
Wyandotte, Michigan

Area			6				7						8					
Matrix Type	MI Soil Background	Laboratory Detection Limits	Subsurf. DB-4 0-2 ft.	Subsurf. DB-4 (L) 0-2 ft.	AVE	MAX	Surface SSP48	Surface SSP49	Surface SSP50	Subsurf. DB-20 0-2 ft.	AVE	MAX	Subsurf. DB-8 0-2 ft.	Subsurf. DB-8 (L) 0-2 ft.	Surface SSP-51	Surface SSP-52	AVE	MAX
Date Sampled			3/90	3/90			9/90	9/90	9/90	9/90			3/90	3/90	9/90	9/90		
Inorganics																		
Arsenic	0.7-15.9	1					N/A	N/A	N/A	N/A			6.6*		N/A	N/A		
Beryllium	None	0.5	N/A				N/A	N/A	N/A	N/A			N/A		N/A	N/A		
Cadmium	1.0-1.55	1	N/A				N/A	N/A	N/A	N/A			N/A		N/A	N/A		
Chromium	3.0-24.5	1	N/A				N/A	N/A	N/A	N/A			N/A		N/A	N/A		
Copper	4.5-82.5	5	N/A				N/A	N/A	N/A	N/A			N/A		N/A	N/A		
Lead	6-56	0.2					6.8		21.2	53	20.3	53	58.4		N/A	N/A	14.7	58.4
Mercury	0.04-0.50	0.25					0.59	33.5		0.81	8.8	33.5			N/A	N/A		
Nickel	2.5-16	5	N/A				N/A	N/A	N/A	N/A			N/A		N/A	N/A		
Selenium	None	0.5	N/A				N/A	N/A	N/A	N/A			N/A		N/A	N/A		
Silver	None	1	N/A				N/A	N/A	N/A	N/A			N/A		N/A	N/A		
Zinc	18-79	1	N/A				N/A	N/A	N/A	N/A			N/A		N/A	N/A		
Priority Pollutant Volatiles																		
Benzene	None	0.005																
Carbon Tetrachloride																		
Chlorobenzene																		
Chloroform	None	0.005																
1,2-Dichloroethane	None	0.005																
1,2-Dichloroethene	None	0.005																
1,2-Dichloropropane	None	0.005					0.123		0.215	1.9	0.56	1.9			0.11	0.254	0.09	0.25
Ethylbenzene	None	0.005																
Methylene Chloride	None	0.005	N/A	0.01					0.017	0.008	0.007	0.017			0.014	0.015		
Tetrachloroethylene	None	0.005																
Toluene	None	0.005						0.012	0.014	0.007	0.009	0.014			0.015	0.014	0.008	0.015
1,1,2-Trichloroethane	None	0.005																
Trichloroethylene	None	0.005		0.47	0.24	0.47												
Trichlorofluoromethane	None	0.01	N/A															
Vinyl Chloride																		
Priority Pollutant Semivolatiles																		
Acenaphthene	None	0.33													N/A	N/A		
Anthracene	None	0.33													N/A	N/A		
Benzo(a)anthracene	None	0.33						0.971		0.818	0.53	0.97			N/A	N/A		
Benzo(a)pyrene	None	0.33						0.632		0.619	0.39	0.63			N/A	N/A		
3,4-Benzofluoranthene	None	0.33	N/A												N/A	N/A		
Benzo(g,h,i)perylene	None	0.33						0.418		0.456	0.30	0.46			N/A	N/A		
Benzo(b or k)fluoranthene	None	0.33						1.332		1.262	0.73	1.33			N/A	N/A		
bis(2-Chloroethyl)ether	None	0.33	N/A	0.34	0.25	0.34									N/A	N/A		
bis(2-Chloroisopropyl)ether	None	0.33													N/A	N/A		
Chrysene	None	0.33						0.926		0.783	0.51	0.93			N/A	N/A		
Dibenzo(a,h)anthracene	None	0.33													N/A	N/A		
Fluoranthene	None	0.33						1.81		1.29	0.86	1.81	0.50		N/A	N/A		
Fluorene	None	0.33													N/A	N/A		
Indeno(1,2,3-cd)pyrene	None	0.33						0.373		0.432	0.28	0.43			N/A	N/A		
1-Methylnaphthalene							0.424								N/A	N/A		
2-Methylnaphthalene							0.603								N/A	N/A		
Naphthalene	None	0.33	53.5 Q	0.34											N/A	N/A		
Phenanthrene	None	0.33		0.34			0.335	1.92	0.335	0.479					N/A	N/A		
Pyrene	None	0.33						2.14		1.1					N/A	N/A		
PCBs																		
PCB-1254	None	0.32					N/A	N/A	N/A	N/A			2.30	2.3	2.15	1.1	1.96	2.3

Blanks indicate not detected.
N/A - Not analyzed.
*Below Michigan soil background level. Thus, not included in average calculations.
Surface indicates shallow sampling.
Subsurface means that a drill rig was used to collect split spoon samples.
(L) - Laboratory result; other results from FAST unit.

Table 3-1
Samples Used In Quantitative Risk Assessment
BASF Corporation - South Works
Wyandotte, Michigan

Area			9				10						11				12				
Matrix Type	MI Soil Back-ground	Laboratory Detection Limits	Surface SS7A	Surface SS7B	AVE	MAX	Surface SSP53	Surface SSP63	Surface SSP64	Subsurf. DB29 3-5 ft.	AVE	MAX	Subsurf. MW-7 S-6 2-4 ft.	Surface SSP54	Surface SSP57	AVE	MAX	Surface S4A	Surface S4B	Subsurf. DB24 3-5 ft.	AVE	MAX
Date Sampled:			10/89	10/89			9/90	9/90	9/90	9/90			9/90	9/90	9/90			10/89	10/89	9/90		
Inorganics																						
Arsenic	0.7-15.9	1	52.9	7.7*	26.9	52.9	N/A	N/A	N/A	N/A			8.0*	N/A	N/A			5*	4.9*	N/A		
Beryllium	None	0.5					N/A	N/A	N/A	N/A			0.6	N/A	N/A					N/A		
Cadmium	1.0-1.55	1					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Chromium	3.0-24.5	1	24*	21*			N/A	N/A	N/A	N/A			10*	N/A	N/A			20*	17*	N/A		
Copper	4.5-82.5	5	30*	16*			N/A	N/A	N/A	N/A			27*	N/A	N/A			17*	17*	N/A		
Lead	6-56	0.2	138	101	119	138	N/A	N/A	N/A	N/A			23*	N/A	N/A			13*	83	N/A	27.8	83
Mercury	0.04-0.50	0.25	8.24	11.2	9.72	11.2		2.12	0.52	N/A	0.78	2.12		10.8	2.31	4.45	10.8		172	11.7	61.3	172
Nickel	2.5-16	5	21	43			N/A	N/A	N/A	N/A			19	N/A	N/A			21	10*	N/A		
Selenium	None	0.5					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Silver	None	1					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Zinc	18-79	1	107	38*			N/A	N/A	N/A	N/A			34*	N/A	N/A			39*	43*	N/A		
Priority Pollutant Volatiles																						
Benzene	None	0.005							0.010		0.004	0.01	0.013	0.01	0.007	0.01	0.013					
Carbon Tetrachloride														0.023		0.009	0.023					
Chlorobenzene									0.022	0.012	0.009	0.022										
Chloroform	None	0.005	0.005		0.004	0.005		0.038			0.011	0.038		0.198	0.008	0.07	0.198			0.052	0.019	0.052
1,2-Dichloroethane	None	0.005						0.043	1.26		0.33	1.26	0.04		0.021	0.021	0.04		0.017	0.076	0.032	0.076
1,2-Dichloroethene	None	0.005																				
1,2-Dichloropropane	None	0.005		0.008	0.005	0.008	0.138	0.086	0.50		0.18	0.5	0.15	0.041	0.054	0.082	0.15		0.005	0.516	0.17	0.52
Ethylbenzene	None	0.005		0.012	0.007	0.012		0.016			0.006	0.016		0.016		0.007	0.016					
Methylene Chloride	None	0.005						0.047		0.006	0.014	0.047			0.021	0.009	0.021			0.041	0.015	0.041
Tetrachloroethylene	None	0.005		0.015	0.009	0.015		0.009			0.004	0.009		0.368	0.009	0.127	0.368					
Toluene	None	0.005		0.006	0.004	0.006	0.014	0.023	0.009		0.012	0.023		0.007	0.014	0.008	0.014		0.006	0.009	0.006	0.009
1,1,2-Trichloroethane	None	0.005																				
Trichloroethylene	None	0.005												0.034		0.013	0.034					
Trichlorofluoromethane	None	0.01						0.019			0.007	0.019		0.11	0.055	0.056	0.11	0.007				
Vinyl Chloride									0.141		0.037	0.141										
Priority Pollutant Semivolatiles																						
Acenaphthene	None	0.33					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Anthracene	None	0.33					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Benzo(a)anthracene	None	0.33		0.6	0.38	0.6	N/A	N/A	N/A	N/A				N/A	N/A				0.5	N/A	0.28	0.5
Benzo(a)pyrene	None	0.33		0.47	0.31	0.47	N/A	N/A	N/A	N/A				N/A	N/A				0.4	N/A	0.24	0.4
3,4-Benzofluoranthene	None	0.33	0.37	0.77	0.57	0.77	N/A	N/A	N/A	N/A				N/A	N/A				0.57	N/A	0.3	0.57
Benzo(g,h,i)perylene	None	0.33					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Benzo(b or k)fluoranthene	None	0.33		0.37	0.27	0.37	N/A	N/A	N/A	N/A				N/A	N/A				0.4	N/A	0.24	0.4
bis(2-Chloroethyl)ether	None	0.33					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
bis(2-Chloroisopropyl)ether	None	0.33					N/A	N/A	N/A	N/A			0.33	N/A	N/A	0.22	0.33			N/A		
Chrysene	None	0.33	0.4	0.6	0.5	0.6	N/A	N/A	N/A	N/A				N/A	N/A				0.6	N/A	0.31	0.6
Dibenzo(a,h)anthracene	None	0.33					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Fluoranthene	None	0.33	0.37	0.9	0.6	0.9	N/A	N/A	N/A	N/A				N/A	N/A				0.87	N/A	0.4	0.87
Fluorene	None	0.33					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Indeno(1,2,3-cd)pyrene	None	0.33					N/A	N/A	N/A	N/A				N/A	N/A					N/A		
1-Methylnaphthalene							N/A	N/A	N/A	N/A				N/A	N/A					N/A		
2-Methylnaphthalene							N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Naphthalene	None	0.33		0.33			N/A	N/A	N/A	N/A				N/A	N/A					N/A		
Phenanthrene	None	0.33	0.47	1.0			N/A	N/A	N/A	N/A				N/A	N/A				0.77	N/A		
Pyrene	None	0.33	0.67	1.4			N/A	N/A	N/A	N/A				N/A	N/A				1.2	N/A		
PCBs																						
PCB-1254	None	0.32	0.472	0.663	0.57	0.66	N/A	N/A	N/A	N/A				N/A	N/A				0.705	N/A	0.45	0.705

Blanks indicate not detected.
N/A - Not analyzed.
*Below Michigan soil background level. Thus, not included in average calculations.
Surface indicates shallow sampling.
Subsurface means that a drill rig was used to collect split spoon samples.
(L) - Laboratory result; other results from FAST unit.

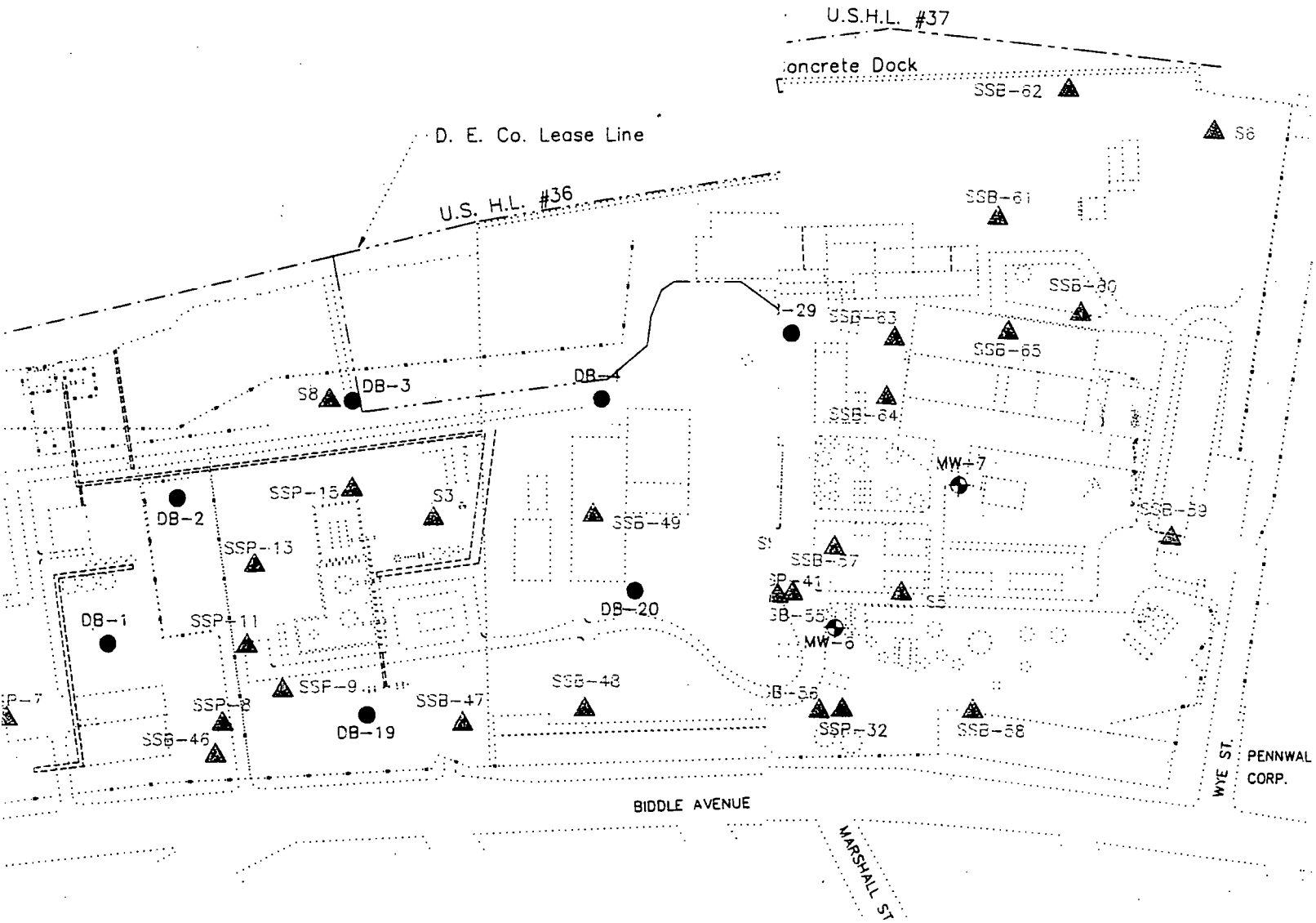
Table 3-1
Samples Used in Quantitative Risk Assessment
BASF Corporation - South Works
Wyandotte, Michigan

Area				12				13					14				15				16					
Matrix Type	MI Soil Back-ground	Laboratory Detection Limits	Subsurf. MW-6 S-2 2-4 ft.	Surface SSP55	Surface SSP56	AVE	MAX	Surface SSA	Surface SSB	Surface SSP58	AVE	MAX	Surface SSA	Surface SSB	Surface SSP62	AVE	MAX	Surface SSP59	Surface SSP60	Surface SSP61	Surface SSP63	AVE	MAX
Date Sampled			10/89	9/90	9/90			10/89	10/89	9/90			10/89	10/89	9/90			9/90	9/90	9/90	9/90		
Inorganics																							
Arsenic	0.7-15.9	1		N/A	N/A			4.8*	6.0*	N/A			3.9*	39	N/A			N/A	N/A	N/A	N/A		
Beryllium	None	0.5		N/A	N/A					N/A					N/A			N/A	N/A	N/A	N/A		
Cadmium	1.0-1.55	1		N/A	N/A				2.0	N/A					N/A			N/A	N/A	N/A	N/A		
Chromium	3.0-24.5	1	5*	N/A	N/A			25	45	N/A			17*	16*	N/A			N/A	N/A	N/A	N/A		
Copper	4.5-82.5	5		N/A	N/A			26*	55*	N/A			7*	17*	N/A			N/A	N/A	N/A	N/A		
Lead	6-56	0.2		12	507	173	507	61	195	N/A	85.4	195	27*	42*	N/A			5.8	16.2	72.7	35.8	32.6	72.7
Mercury	0.04-0.50	0.25		0.29	1.61	0.72	1.61	0.43*	0.98	N/A	0.55	0.98	0.68	2.85	1.18	1.57	2.85			15.3	1.88	4.4	15.3
Nickel	2.5-16	5		N/A	N/A			18	19	N/A			7*	11*	N/A			N/A	N/A	N/A	N/A		
Selenium	None	0.5		N/A	N/A					N/A					N/A			N/A	N/A	N/A	N/A		
Silver	None	1		N/A	N/A					N/A					N/A			N/A	N/A	N/A	N/A		
Zinc	18-79	1	8*	N/A	N/A			128	299	N/A			28*	41*	N/A			N/A	N/A	N/A	N/A		
Priority Pollutant Volatiles																							
Benzene	None	0.005	0.012	0.007		0.007	0.012			0.315	0.11	0.31											
Carbon Tetrachloride																							
Chlorobenzene				0.016		0.007	0.016																
Chloroform	None	0.005	0.012		3.35	1.12	3.35		0.17														
1,2-Dichloroethane	None	0.005	0.16	0.097		0.09	0.16																
1,2-Dichloroethene	None	0.005																					
1,2-Dichloropropane	None	0.005	38	0.066	1860	633	1860		0.92	0.097	0.34	0.92			0.072	0.026	0.072	0.008	0.010	0.046	0.039	0.026	0.046
Ethylbenzene	None	0.005								0.035	0.01	0.035		0.012		0.006	0.012				0.008	0.004	0.008
Methylene Chloride	None	0.005		0.017						0.020	0.008	0.02			0.060	0.022	0.06		0.036	0.068	0.091	0.049	0.091
Tetrachloroethylene	None	0.005													0.069	0.025	0.069						
Toluene	None	0.005	0.011	0.021		0.01	0.02		0.006	0.028	0.012	0.028		0.022	0.038	0.021	0.038			0.026	0.025	0.014	0.026
1,1,2-Trichloroethane	None	0.005																					
Trichloroethylene	None	0.005													0.019	0.008	0.019				0.010	0.004	0.01
Trichlorofluoromethane	None	0.01								0.038	0.014	0.038	0.007	0.012	0.062	0.027	0.062				0.018	0.006	0.018
Vinyl Chloride																							
Priority Pollutant Semivolatiles																							
Acenaphthene	None	0.33		N/A	N/A																		
Anthracene	None	0.33		N/A	N/A																		
Benzo(a)anthracene	None	0.33		N/A	N/A			0.33	0.43		0.31	0.43	0.4	0.57		0.38	0.57						
Benzo(a)pyrene	None	0.33		N/A	N/A			0.6	0.33		0.36	0.6	0.47	0.37		0.33	0.47						
3,4-Benzofluoranthene	None	0.33		N/A	N/A			0.7	0.46		0.44	0.7	0.432			0.25	0.43						
Benzo(g,h,i)perylene	None	0.33		N/A	N/A								0.4			0.24	0.4						
Benzo(b or k)fluoranthene	None	0.33		N/A	N/A																		
bis(2-Chloroethyl)ether	None	0.33	0.37	N/A	N/A	0.23	0.37			N/A					N/A			N/A	N/A	N/A	N/A		
bis(2-Chloroisopropyl)ether	None	0.33	21	N/A	N/A	7.11	21	3.4	8.3	N/A	3.95	8.3			N/A			N/A	N/A	N/A	N/A		
Chrysene	None	0.33		N/A	N/A			0.47	0.57		0.4	0.57	0.432	0.73		0.44	0.73						
Dibenzo(a,h)anthracene	None	0.33		N/A	N/A																		
Fluoranthene	None	0.33		N/A	N/A			0.63	0.6				0.33							0.444			
Fluorene	None	0.33		N/A	N/A																		
Indeno(1,2,3-cd)pyrene	None	0.33		N/A	N/A																		
1-Methylnaphthalene				N/A	N/A					1.64					0.346								
2-Methylnaphthalene				N/A	N/A					2.14					0.477					0.515	0.469		
Naphthalene	None	0.33		N/A	N/A				0.4	1.26			1.0							0.351			
Phenanthrene	None	0.33		N/A	N/A			0.6	0.7	0.831			0.8	3.3	0.489					0.585			
Pyrene	None	0.33		N/A	N/A			0.97	0.97				0.73	1.1	0.512					0.526			
PCBs																							
PCB-1254	None	0.32		N/A	N/A			1.55	8.19	N/A	3.35	8.19											

Blanks indicate not detected.
N/A - Not analyzed.
*Below Michigan soil background level. Thus, not included in average calculations.
Surface indicates shallow sampling.
Subsurface means that a drill rig was used to collect split spoon samples.
(L) - Laboratory result; other results from FAST unit.

Figure 3-3
Approximate Sample Locations Used in uantitative Risk Assessme
BASF Corporation - South Work
Wyandotte, Michigan

ring Location
Sample Location
Well Location



400 600 800
in Feet

tevens 2.11.90	Checked by / Date:
Pomante 10.4.90	Checked by / Date:

The ERM Group

The semi-volatile organics contain two classes: the base-neutrals and the acid extractables. Base-neutrals are those compounds which require basic or neutral pH conditions for extraction from environmental matrices. In general, these compounds are quite strongly adsorbed to available organic matter, such as soils/sediments or suspended particles. Therefore, the movement of base-neutrals through soils and ground water systems can be substantially retarded. However, they may be readily transported via surface runoff to surface waters during intense rainfall events and to the atmosphere as fugitive dust. Selected compounds in this group, such as the ethers, may volatilize from soils and surface waters. Base-neutrals detected, related to past operations, and used to represent this class, were bis(2-chloroisopropyl)ether and polynuclear aromatic hydrocarbons (PNAs).

The acid extractables are phenolic and cresol compounds which require acidic pH conditions for their extraction from environmental samples. These compounds have moderate to high water solubilities and extremely low volatilization rates. As a class, the degree of adsorption onto soils/sediments and suspended particles is mixed. Acid extractables do not readily volatilize, but are susceptible to oxidation, photolysis, and biodegradation. This class of compounds was not selected since the presence of acid extractables on the Site was negligible based on the field investigation.

The inorganics contain the trace elements and the metals. Fate and transport processes are dependent upon the chemical speciation of the inorganic constituent. In general, the inorganics are not soluble in water and do not volatilize. However, these constituents may adsorb to soils or sediments, or suspended particles, thus limiting their transport to the ground water, surface water, and atmosphere. The inorganics detected, related to past operations, and used to represent the class, were mercury and zinc.

Pesticides/PCBs are not water soluble and are generally nonvolatile. They have a high affinity for soil, and adsorption limits their transport to ground water. Run-off to surface water and atmospheric transport of fugitive dust are two reasons for the widespread presence of these compounds in the environment. Pesticides were not detected in the samples from the Site, but PCBs were detected.

3.2.4 Summary of the Compounds

All compounds were selected using the approach outlined in Section 3.2.1. The compounds selected for the Site risk assessment were based on the limited number of compounds detected Site-wide, a greater than 50 percent detection of all samples, and concentrations in excess of standards. These compounds are summarized below by potentially affected medium.

- Ground Water Discharge to Surface Water (worst case with no recovery system in place)

  Arsenic
  Benzene
  bis(2-Chloroethyl)ether
  bis(2-Chloroisopropyl)ether
  Chromium
  Copper
  1,2-Dichloroethane
  1,2-Dichloropropane
  Mercury
  Nickel
  PCBs
  Polynuclear Aromatic Hydrocarbons (PNAs)
  Trichloroethene
  Vinyl chloride
  Zinc

- Soils

  Arsenic
  Benzene
  bis(2-Chloroethyl)ether
  bis(2-Chloroisopropyl)ether
  1,2-Dichloroethane
  1,2-Dichloroethene
  1,2-Dichloropropane
  Lead
  Mercury
  PCBs
  PNAs (sum of B2 Carcinogens only)
  Tetrachloroethene

- Soils (Con't.)

  Toluene
  Trichloroethene
  Vinyl Chloride

- Air (volatilized compounds from soils only)

  Benzene
  bis (2-Chloroethyl)ether
  bis (2-Chloroisopropyl)ether
  1,2-Dichloropropane
  1,2-Dichloroethane
  1,2-Dichloroethene
  Tetrachloroethene
  Toluene
  Trichloroethene
  Vinyl chloride

3.3 Toxicity Evaluation

3.3.1 Approach

The selected compounds are subjected to a toxicity evaluation to develop a data base in which exposure point intakes can be compared during risk characterization. This evaluation includes the consideration of experimental studies using mammals and aquatic (nonmammalian) species, where available, as well as relevant standards or criteria for humans. This evaluation presents summaries of health effects data, environmental levels of concern, toxicokinetics, toxicodynamics, ecotoxicology, and regulatory standards or criteria available for the compounds. The detailed methodology for the toxicity evaluation is included in Appendix I.

Evaluations of carcinogenicity involve two steps: (1) the identification of potential carcinogens among the compounds detected at a site, and (2) the quantitative determination of their carcinogenic potency. Evidence of possible carcinogenicity in humans comes primarily from long-term animal tests and epidemiological investigations. Results from these studies are supplemented with information from short-term tests, pharmacokinetic studies, comparative metabolism studies, structure-activity relationships, and other relevant sources.

The quantitative portion of the evaluation entails identifying the relevant indices of toxicity against which calculated intakes can be compared in the risk characterization of the Site. The toxicity indices for the Site compounds are presented in Table 3-2. The qualitative aspect of the evaluation includes a summary of the pertinent toxicology data for each compound, as well as EPA and International Agency for Research on Cancer (IARC) weight-of-evidence classification that describes potential for human carcinogenicity.

The weight-of-evidence carcinogenicity classification for each compound is presented in the following section.

3.3.2 Weight-of-Evidence Classification

Benzene, arsenic, and vinyl chloride have been classified by both EPA and IARC as known human carcinogens. This rating corresponds to Group A and Class 1, respectively, (i.e., adequate human evidence of carcinogenicity with sufficient animal evidence).

1,2-Dichloroethane, 1,2-dichloropropane, trichloroethene, bis(2-chloroethyl)ether, tetrachloroethene, PNAs (sum of A, B1, and B2 compounds only), and PCBs have been classified as Group B2 and Class 2 carcinogens by EPA and IARC, respectively. These ratings correspond to sufficient animal evidence, but inadequate human evidence of carcinogenicity.

Nickel and chromium are EPA Group A carcinogens for the inhalation pathway only. Since this assessment does not involve inhalation of metal particulates (e.g., refinery worker exposure), these constituents are considered as noncarcinogens.

The noncarcinogens (e.g., inadequate evidence of carcinogenicity in animals and no evidence in humans) are copper, mercury, zinc, bis(2-chloroisopropyl)ether, toluene, and 1,2-dichloroethene. This classification was designated by EPA; to date, some of these compounds have not been classified by IARC.

The acute and chronic health effects for the compounds of interest are provided in numerous toxicological reports (e.g. ATSDR profiles) and other medical and toxicological references and, therefore, are not provided in this risk assessment. Table 3-2 contains the toxicological indices for these compounds while Table 3-3 lists the target organ(s) effected by exposure to the compound. These target organs were used in calculating the noncarcinogenic hazard for the Site.

Table 3-2

Relevant Quantitative Indices of Toxicity
BASF Corporation - South Works
Wyandotte, Michigan

Compound	EPA Classification	Oral AIS (mg/kg/day)	Oral RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Oral CPF 1/(mg/kg/day)	Inhalation CPF 1/(mg/kg/day)	Source	IRIS Date
Arsenic	A	NA	Pending	NA	1.75	50	IRIS	12/1/88
Chromium	NC	NA	0.0051	0.0051 (SPHEM, 1986)	NA	No Data	IRIS	3/1/88
Copper	NC	0.0037	0.037	0.037	No Data	No Data	EPA 1984, 1986	Not Available
Lead	NC/B2 (1)	NA	0.00140	NA	Not Available	Not Available	SPHEM, 1986	Not Available
Mercury	NC	0.002	0.0003	NA	No Data	No Data	SPHEM, 1986	Not Available
Nickel	A (inhalation only)	0.02	0.02		No Data	0.84	IRIS	3/1/88
Zinc	NC	NA	0.2		No Data	No Data	SPHEM, 1986	Not Available
Benzene	A		Pending		0.029	0.029	IRIS	3/1/88
1,2-Dichloroethane	B2		No Data		0.091	0.091	IRIS	3/1/88
1,2-Dichloroethene	NC		0.02				IRIS	11/90
1,2-Dichloropropane	B2		No Data		0.068	No Data	PHRED, 1988	Not Available
Trichloroethene	B2		Pending		0.017	0.011	SPHEM, 1986	Not Available
Vinyl Chloride	A		No Data		2.3	0.295 (PHRED, 1988)	EPA, 1987	Not Available
PNAs*	A & B Classes Only		No Data		3.2	0.45	Thorslund	Not Available
bis(2-Chloroethyl)ether	B2		No Data		1.1	1.1	IRIS	3/1/88
bis(2-Chloroisopropyl)ether	NC	0.004	0.04	0.04	No Data	No Data	IRIS	10/1/89
PCBs	B2		No Data		7.7	No Data	IRIS	5/1/89
Tetrachloroethene	BC/C	NA	NA	NA	0.051	0.0033	IRIS	5/1/89
Toluene	NC	NA	0.2	2	No Data	No Data	IRIS	3/1/88

NA - Not applicable
*PNAs evaluated as benzo(a)pyrene toxicity equivalents
AIS - Acceptable intake for subchronic exposure
RfD - Reference dose (= AIC)
CPF - Carcinogenic potency factor
(1) Lead has been classified as a B2 carcinogen, but slope factors have not been developed. Therefore, the compound was evaluated as a noncarcinogen using previously published RfD.

IRIS - Integrated Risk Information System, on-line computer system by EPA
IRIS values based on 1 May 1990 update
EPA 1984 - Health Effects Assessment for Copper
EPA 1986 - Superfund Public Health Evaluation Manual
EPA 1987 - Health Advisories for 25 Organics
SPHEM - Superfund Public Health Evaluation Manual, 1986
PHRED - Public Health Risk Evaluation Database, computer disc dated 9/88

Table 3-3
Target Organs for the Noncarcinogenic Compounds of Interest
BASF - South Works
Wyandotte, Michigan

Compound	Target Organ
bis(2-Chloroisopropyl)ether	Kidney, Liver Skin
Chromium	Kidney, Liver Immune System
Copper	Kidney, Liver
Lead	Brain Kidney
Nickel	Respiratory Immune System, Skin
1,2-Dichloroethene	Liver, Lung Heart
Toluene	CNS Kidney, Brain
Zinc	Digestive System Lungs

Source: ATSDR profiles for the individual compounds.
(1) Target organ effects are presented based on very high levels of the compound and are not levels associated with drinking water or food.
(2) Oral or dermal exposures only. Fugitive dust is not an issue at this site.
CNS - Central nervous system.

3.4 Exposure Evaluation

3.4.1 Approach

The purpose of an exposure evaluation is to establish the populations at risk, the potential routes of exposure, source areas on the Site and the magnitude of expected exposure (i.e., resultant intake). The assessment considers exposures resulting from detected levels, as well as future worst-case exposure levels which could result if no action were taken. A potentially affected population can then be defined and the exposure intakes can be calculated based on information regarding sources, migration of compounds, and the medium in which compounds were detected. The sources and the concentrations of the compounds in each medium found at this Site are discussed in Section 2.

The steps in an exposure evaluation are presented in the following subsections:

- Sources,
- Environmental fate and transport,
- Conceptual Model,
- Exposure scenarios,
- Potentially affected populations, and
- Resultant intakes.

The exposure equations, exposure coefficients, and standard parameters are derived from MDNR Draft Risk Assessment Guidelines (MDNR, 1990), the Superfund Exposure Assessment Manual (EPA, 1988a), Exposure Factors Handbook (EPA, 1989a), agencies such as the Radiation Council and Agency for Toxic Substances and Disease Registry, and best professional judgment of those conducting the risk assessment. These factors are continually updated using recent publications by researchers in the various fields.

3.4.2 Source

The primary source at the Site is a result of processing and manufacturing practices over the past 100 years. This industrial use has impacted the subsurface environment. Infiltration of water through the affected soils has caused migration of the compounds to deeper soils and ground water.

The water table is equal to or above the elevation of the Detroit River, or three to eight feet below land surface. Ground water discharges at extremely low rates to the Detroit River (Papadopulos 1984). Ground water has been and is currently being recovered at the Site. Ground water is still flowing through the Site because of rainfall and regional water movement. However, the contaminants in the ground water are being prevented from migrating off site by the existing ground water system installed in accordance with the Consent Decree between BASF and MDNR.

3.4.3 Environmental Fate and Transport

The first step in the analysis of exposure is to evaluate the fate and transport processes for the compounds in a qualitative manner (further described in Appendix I). This step is taken so that the potential for releases from sources is considered in the exposure analysis. This analysis also identifies any significant intermedia transport routes that may require further detailed investigation through fate and transport modeling.

Physical and chemical parameters affect environmental mobility of chemicals and provide an indication of migratory potential for compounds. These parameters are vapor pressure, water solubility, log octanol/water partition coefficient, soil/sediment adsorption coefficient, and specific gravity.

The compounds chosen for the risk assessment behave differently in the environmental media being considered: air (vapors), surface water (e.g., worst case conditions assumed no ground water recovery system in place and all contaminants entering the Detroit River), and soil. In general, the volatile organics and chlorinated ethers tend to be mobile in the environment based on their water solubilities and vapor pressure. Table 3-4 presents the relative importance of processes influencing the fate and transport for the compounds. Table 3-5 details the physical-chemical properties of the compounds that determine their environmental fate and transport.

Based on previous studies by MDNR, BASF and Papadopulos, and supported by this study's finding, Site conditions are at steady-state. The concentrations of compounds detected in all of the studies are in the same order of magnitude and are not increasing with time. Additionally, these areas remain localized and migration is apparently slow.

Table 3-4
Important Fate and Transport Processes for
Compounds at BASF Corporation - South Works
Wyandotte, Michigan

Compound	Major Processes
Arsenic	Sorption, Biodegradation, Chemical Speciation
Chromium	Sorption, Chemical Speciation, Bioaccumulation
Copper	Sorption, Chemical Speciation
Mercury	Sorption, Photolysis, Chemical Speciation, Volatilization, Bioaccumulation
Nickel	Sorption, Bioaccumulation
Zinc	Sorption, Bioaccumulation
Benzene	Oxidation, Biodegradation, Volatilization
1,2-Dichloroethane	Volatilization
1,2-Dichloroethene	Volatilization
1,2-Dichloropropane	Volatilization
Trichloroethene	Volatilization, Biodegradation, Bioaccumulation, Oxidation
Vinyl Chloride	Volatilization, Photolysis, Biodegradation
PNAs	Sorption, Biodegradation Bioaccumulation, Photolysis
bis(2-Chloroethyl)ether	Volatilization, Biodegradation
bis(2-Chloroisopropyl)ether	Volatilization
PCBs	Sorption, Bioaccumulation
Toluene	Volatilization, Biodegradation, Sorption
Tetrachloroethene	Volatilization, Biodegradation, Bioaccumulation, Oxidation
Lead	Sorption, Bioaccumulation, Chemical Speciation

Table 3-5

Physical and Chemical Properties of the Compounds at BASF Corporation - South Works Wyandotte, Michigan

	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Benzene	1,2-Dichloro-ethane	1,2-Dichloro-ethene
Molecular Weight, g/mole	74.92	51.996	63.546	207.2	200.59	58.7	65.38	78.11	98.96	96.95
Melting Point, C°	814	1857	1083.4	327.4	-38.82	1455	419.5	5.5	-35.3	-50
Boiling Point, C°	613	2672	2567	1755	356.72	2920	908	80.1	83.5	47.5
Density, g/mL - organics g/cubic cm - inorganics	5.727 (SG)	7.20 (28°C) (SG)	8.92 (SG)	11.35 (SG)	13.534 (SG)	8.9 (SG)	7.14 (SG)	0.8765	1.2529	1.218
Partition Coefficients										
Water Solubility, ppm (25°C) mg/L	insoluble	insoluble	insoluble	insoluble	0.0813 (30°C)	insoluble	insoluble	1780	8690	600
Octanol-Water, Kow	NA	NA	NA	NA	NA	NA	NA	135	30	123
Sediment-Water, Koc	NA	NA	NA	NA	10	NA	0.1 - 8000	65	14	59
Volatilization Coefficients										
Henry's Law Constants (atm m3/mole)	NA	NA	NA	NA	NA	NA	NA	0.0055	0.045	0.067
Vapor Pressure, mm Hg (25°C) - inorganics torr - organics	-	1 (1616°C)	10 (1870°C)	NA	0.002 (25)	1 (1810°C)	1 (487°C)	95	61 (20°C)	326

SG - Specific Gravity
NA - Not available

SOURCES:
Verschueren, 1983
Weast, 1974
Mills, et al., 1982
ATSDR Profiles, 1987 to 1989

Table 3-5

Physical and Chemical Properties of the Compounds at BASF Corporation - South Works Wyandotte, Michigan

	1,2-Dichloro-propane	Trichloro-ethene	Vinyl Chloride	PNAs	bis(2-chloro-ethyl)ether	bis(2-chloro-isopropyl)ether	Tetrachloro-ethene	Toluene	PCBs
Molecular Weight, g/mole	112.99	131.4	62.5	252.3	143.04	171.1	165.83	92.14	328.4
Melting Point, C°	-100	-87.1	-153.8	179	-24.5	-97	-22.7	-95	NA
Boiling Point, C°	96.37	86.7	-13.4	310	178	189	121	110.6	365 - 390
Density, g/mL - organics g/cubic cm - inorganics	1.15597	1.465	0.969	1.351	1.2199	1.11	1.626	0.867	1.5
Partition Coefficients									
Water Solubility, ppm (25°C) mg/L	2700 (20)	1100	2700	0.0038	10200	1700	200	535	0.012 - 0.031
Octanol-Water, Kow	105	263	17	1550000	29	126	759	620	3162278
Sediment-Water, Koc	51	126	8.2	550000	13.9	61	364	300	530000
Volatilization Coefficients									
Henry's Law Constants (atm m3/mole)	0.00207 (20)	0.011	0.0814	0.00000049	0.0000131	0.00011	0.153	0.00666	0.0026
Vapor Pressure, mm Hg (25°C) - inorganics torr - organics	49.67	74	2660	5.6E-09	0.71	0.85 (20°)	14 (20°C)	28.7	0.0000771

SG - Specific Gravity
NA - Not available

SOURCES:
Verschueren, 1983
Weast, 1974
Mills, et al., 1982
ATSDR Profiles, 1987 to 1989

3.4.4 Conceptual Model

The conceptual model for the South Works Site is shown in Figure 3-4. A 6- to 12-inch clean clay soil layer was applied to the Site after the buildings were razed. The eastern one-half to two-thirds of the South Works Site consists of reclaimed river bottom and marshland composed of fill materials of varying composition. This fill material overlies naturally deposited lacustrine clays. Near the river, the fill thickness increases to a depth of approximately 25 feet. The fill material is approximately 3 feet in depth near Biddle Avenue. The fill material occupies the entire length of the Site and is present as a wedge-shaped unit, increasing in thickness eastward from Biddle Avenue, as depicted in Figure 3-4. Beneath the fill material are native soils consisting of a thin layer of organic material or peat and sand overlying thick clays. The Papadopulos study showed that the direction of shallow ground water flow is predominantly toward the east and the Detroit River with a minor component of flow toward Biddle Avenue in the western portion of the Site. Ground water flow directions are described in Section 2.2.3.

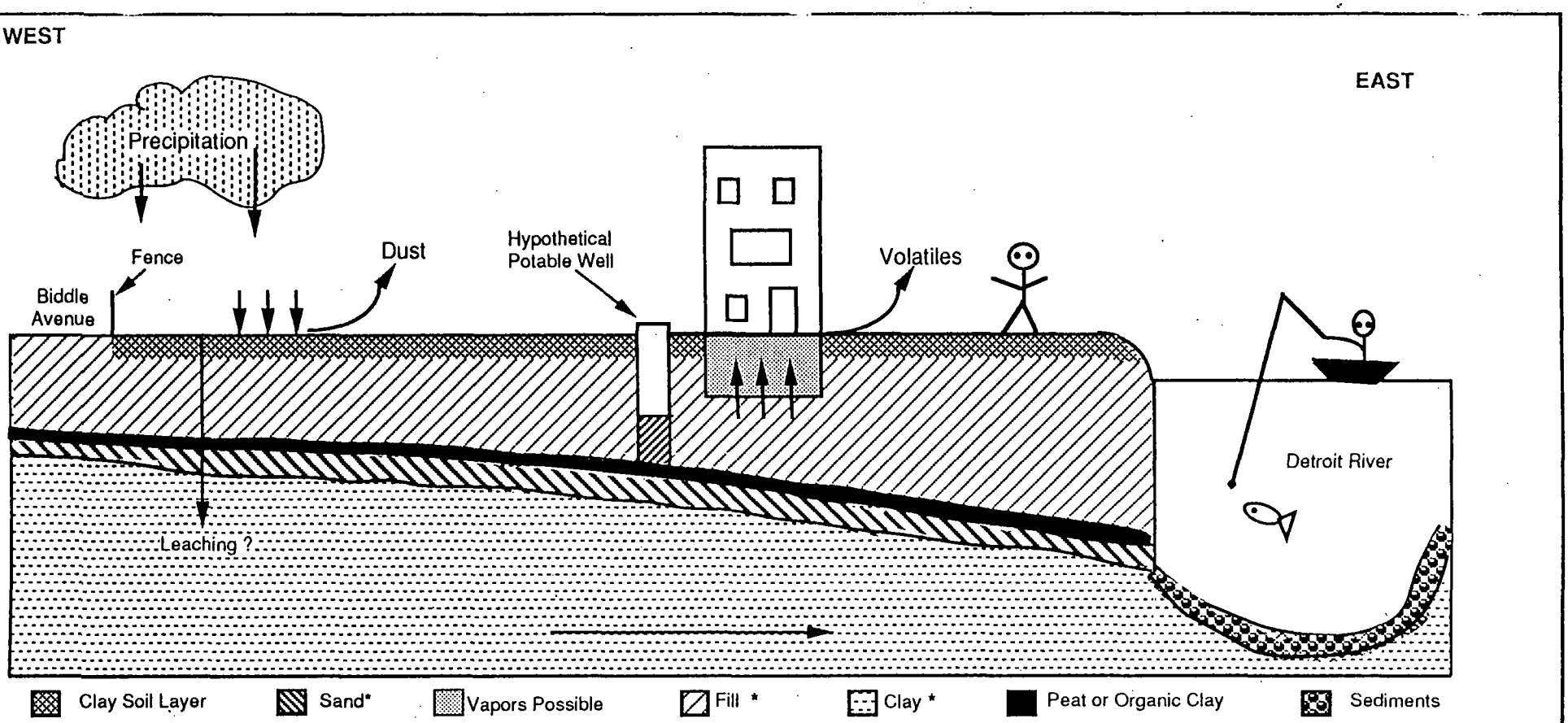
The primary receptor for ground water flow is the Detroit River with potential exposure points located on the river. Additional potential receptors are people (e.g., workers or residents) who might occupy the Site in the future. Exposures, such as volatile emissions and direct contact with the soils, are possible.

3.4.5 Exposure Scenarios

Exposure scenarios were determined by integrating information from the Site Investigation with knowledge about potentially exposed populations and their behavior. The mode of potential exposure to the population, such as inhalation, ingestion, or dermal contact, is identified as part of the exposure scenarios.

The existing Site conditions are as follows:

- Regionally, ground water is not and cannot be used for human consumption because low yields exist in the ground water in the fill material, high sulfide content exists in the bedrock aquifer, and public water is readily available;
- Ground water is currently being recovered in selected areas;



Ground water flow direction

* Approximate thicknesses since conditions vary across the site.

DRAWING NOT TO SCALE

WO# 160.22.01.01	Drawn By: DLM 12/4/90 Revised by: TAS 12/17/90	BASF Corporation South Works, Wyandotte, Michigan	FIGURE 3-4 CONCEPTUAL MODEL	The ERM Group

- Site ground water discharges to the Detroit River, although a majority of ground water contaminants are intercepted by the recovery system;
- Surface water is represented by the Detroit River;
- Surficial soil samples were collected and analyzed across the Site;
- Soil gas surveys and analytical results indicated concentrations of some compounds above background and analytical detection limits;
- A six to twelve inch "clean" clay soil layer exists across the Site;
- All buildings have been demolished; however, the underground infrastructure and foundations still remain;
- The Site is sparsely vegetated;
- Historical review of past operations led to the identification of source areas;
- Residential/commercial areas are located west of the Site; industry to the south; Detroit River to the east; and commercial establishments to the north;
- The Site consists of 84 acres;
- The Site is currently fenced on three sides with the Detroit River bordering the fourth side. The Site is accessible through several gates; and
- Present concentrations of compounds are in steady-state conditions.

Exposure Scenarios by Medium

The primary exposure pathways for the compounds were influenced by the geology and hydrology of the Site, as well as each compound's physical/chemical properties. The pathways were also influenced by any soil disturbances associated with activity on the Site or portions thereof. These factors interact to define the various routes by which the compounds originating at the Site could affect potentially exposed populations. These routes are presented in detail in Table 3-6 and are summarized below.

Table 3-6
Exposure Pathways for
BASF Corporation - South Works
Wyandotte, Michigan

Transport Media	Release Mechanism	Exposure Point	Exposure Route	Selected for Analysis
Surface Water	Ground Water Discharge (1)	Detroit River (recreational)	Dermal Contact Inhalation Incidental Ingestion	Yes - All age groups (actual)
Sediments	Ground Water Discharge Resolution/Dissolution	Detroit River	Dermal Contact	No - Detroit River too deep for contact
Air	Soils Off-Gassing as Vapors	On Site	Inhalation	Yes - All age groups (actual)
Soils (0-4 ft. below land surface)	Absorption	On Site	Dermal Contact Incidental Ingestion	Yes - All age groups (actual)
Fish	Ground Water Discharge	Detroit River	Ingestion	No - Compounds detected in ground water have low bioaccumulation potentials

(1) Ground water discharge from the South Works to the Detroit River is very low as calculated by Papadopulos 1984. Furthermore, the recovery system presently in place prevents migration of contaminants to the Detroit River.

Conservative assumptions concerning duration and frequency of contact with the exposure medium, along with the other standard parameters for calculation of intakes are given in Table 3-7.

Air

Air is considered a potential transport medium since 1) volatile organic compounds were detected in the surficial soil samples, 2) organic vapor analyzer (OVA) readings (e.g., headspace analysis during boring programs) were elevated above background in portions of the Site, and 3) soil gas survey readings indicated elevated concentrations in former processing and manufacturing areas. Because the Site is sparsely vegetated, the air pathway is potentially important because of volatilization of compounds from the soils.

Ground Water

A recovery system is currently in place and ground water is intercepted as an on-going process under a Consent Decree with MDNR. Therefore, direct use of ground water is <u>not</u> considered in this assessment based on previously mentioned conditions.

Surface Water

Surface water is an exposure medium to the extent that people recreationally using the Detroit River might contact contaminants in the river. This exposure examines the possibility that the recovery system is not in place and contaminants could enter the Detroit River. Although this exposure is highly unlikely, it is considered further to evaluate the possibility of ground water recovery system failure. Based on previous ground water work (Papadopulos 1984), an estimate of the surface water concentrations was made and is discussed in a later section.

Soils

Currently, the Site has a sparse vegetation cover. Compounds in soils are in a steady-state condition based on the 100 years of Site activities and the length of time (i.e., 10 years) since processing has ceased.

The current soil exposure scenario consists of dermal contact with, inhalation of, or incidental ingestion of compounds detected in the surface (0 to 2 feet) and subsurface (2 to 4 feet below grade) soils in the area. To facilitate a conservative approach, the maximum and

Table 3-7

Standard Parameters Used for Calculation of Intake
Current Site Conditions
BASF Corporation - South Works
Wyandotte, Michigan

PARAMETER		Standard Value		
		Adult	Child age 6-12	Child age 2-6
Physical Characteristics				
Average Body Weight	(a)	70 kg	29 kg	16 kg
Surface Area Available for Dermal Exposure	(a)	18,150 sq cm	10,420 sq cm	7,200 sq cm
Activity Characteristics				
Amount of Water Ingested	(a)	0.1 liter/day	0.05 liter/day	0.05 liter/day
Amount of Air Breathed (recreational)	(a)	3.0 cu m/hr	1.65 cu m/hr	0.75 cu m/hr
Amount of Air Breathed - Work Environment		3.3 cu m/hr	2.6 cu m/hr	2.1 cu m/hr
Amount of Soil Ingested Daily (Incidental)	(b)	0.1 g	0.1 g	0.2 g
Duration of Soil Contact	(c)	4 hrs/day	4 hrs/day	1 hr/day
Frequency of Soil Contact	(c)	20 days/yr	50 days/yr	15 days/yr
Percentage of Skin Area Contacted by Soils	(a,c)	10%	10%	10%
Absorption Rate of Compounds in Surface Water	(d)	Compound-Specific	Compound-Specific	Compound-Specific
Absorption Via Dermal Contact of Surface Water	(a)	100%	100%	100%
Absorption Via Incidental Ingestion	(a)	100%	100%	100%
Absorption Rate of Inhaled Air - Surface Water	(a)	100%	100%	100%
Surface Water Exposure	(c)	4 hrs/day	4 hrs/day	1 hr/day
Duration of Surface Water Exposure	(c)	20 days/year	40 days/year	10 days/year
Percentage of Skin Area Contacted by Surface Water	(c)	10%	20%	20%
Material Characteristics				
Dust Adherence (Potting Soil)	(a)	1.45 mg/sq cm	1.45 mg/sq cm	1.45 mg/sq cm
Mass Flux Rate (water-based)	(d)	0.5 mg/sq cm/hr	0.5 mg/sq cm/hr	0.5 mg/sq cm/hr

a) Exposure Factors Handbook, EPA, 1989a
b) EPA 1989 Memorandum
c) ERM Staff Professional Judgement Based on Site Conditions
d) Superfund Exposure Assessment Manual, EPA 1988a

average concentrations for surface (0 to 2 feet) and subsurface (2 to 4 feet) soils were selected for the calculation of intakes.

Sediments

Stream sediments are not considered a pertinent exposure medium. Detroit River sediments are not exposed and are not easily accessible from the surface.

3.4.6 Potentially Affected Populations

The determination of potentially affected populations provides an evaluation of the expected degree of human contact with compounds leaving the Site. The results of this determination are used to calculate the resultant intakes incurred by the exposed populations.

This determination involves the following four steps:

- Identification of exposed populations;
- Characterization of population;
- Analysis of population activities; and
- Development of exposure coefficients.

The first step compares the concentration data with the population data to identify and enumerate those populations (human and environmental) that will potentially or actually be exposed. The second step, population characterization, identifies those groups (e.g., infants, elderly, women of child-bearing ages, and endangered or sensitive wildlife species) within the exposed population which may incur a greater risk than the average population as a result of a given exposure. The number of people potentially affected is determined using site-specific information, city planning information, and census data.

The third step, activity analysis, examines the activities (e.g., employment, recreation) of potentially or actually exposed populations to define the extent of exposure of those previously identified and characterized populations.

The final step is the identification of exposure coefficients for the affected population. The exposure coefficient combines information on the frequency and duration of contact with the selected compounds to yield a quantitative value per day. Exposure coefficients are developed for each exposure route to calculate the intakes.

The quantitative analytical data were used to determine potential exposures. Modeling for the Site consisted of volatilized emission calculations and dispersion to an exposed population using the Industrial Source Complex Long-Term (ISCLT) Air Dispersion Model.

Prior to calculation of resultant intakes, the potentially exposed populations were identified. Two different populations were identified for current Site conditions. First, adults, children ages 6-12, and children ages 2-6 who engage in fishing activities on the Detroit River represented potentially exposed populations for the surface water exposures. Secondly, the exposed population for soil and air exposure pathways consisted solely of trespassers on the property. Since inhalation of volatilized compounds from, dermal contact with and incidental ingestion of soils were the possible exposures and because the Site is secured by a fence, only those people who trespass could be exposed. The population evaluated as trespassers consisted of adults, children ages 6-12, and children ages 2-6. Although it is highly unlikely that children between the ages of 2-6 could gain access to the Site, they were included in the exposure calculations. These two populations were assumed to be exposed in different ways and to be affected differently by exposure. The exposure routes for the different populations are outlined in Table 3-8.

Populations in residential and commercial areas adjacent to the Site (e.g., neighboring areas) are affected less by Site conditions than the trespasser population upon which the RA was based. Neighboring areas were not subjected to the dermal contact inhalation or ingestion of soil pathways and were not evaluated further in the soil and air pathways. The neighboring areas might be considered as the population exposed to the surface water. The air pathways and modeling evaluated the maximally exposed person who was located on Site.

3.4.7 Resultant Intakes

General Calculations

The concentration of compounds that populations are exposed to depends on the habits of the population. Assumptions behind these habits are presented in Table 3-9 for each route of exposure.

The methodology used in calculating intakes from the aforementioned exposure routes is presented in Section 3.4.1 and Appendix I. The resulting intakes for chronic and subchronic exposure levels per age

Table 3-8
Routes of Exposure used in Calculation of Intakes
Current Site Conditions
BASF Corporation - South Works
Wyandotte, Michigan

POPULATION	MEDIA	ROUTES OF EXPOSURE
Child, Age 2-6	Surface Water (recreational)	Dermal contact while fishing Inhalation while fishing Incidental ingestion
	Soils (trespasser)	Incidental ingestion Dermal contact
	Air (trespasser)	Inhalation of off-gassed vapors
Child, Age 6-12	Surface Water (recreational)	Dermal contact while fishing Inhalation while fishing Incidental ingestion
	Soils (trespasser)	Incidental ingestion Dermal contact
	Air (trespasser)	Inhalation of off-gassed vapors
Adult	Surface Water (recreational)	Dermal contact while fishing Inhalation while fishing Incidental ingestion
	Soils (trespasser)	Incidental ingestion Dermal contact
	Air (trespasser)	Inhalation of off-gassed vapors

Table 3-9
Characteristics of Subchronic and Chronic Exposure Scenarios
Current Site Conditions
BASF Corporation - South Works
Wyandotte, Michigan

ROUTE OF EXPOSURE	MEDIA	SCENARIO	ACTIVITY	POPULATION	SUBCHRONIC EXPOSURE CHARACTERISTICS	CHRONIC EXPOSURE CHARACTERISTICS
Ingestion	Surface water (Detroit River)	Actual (Recreational)	Casual Drinking	Child age 2-6 Child age 6-12 Adult	Ingestion of 0.05 L (child age 2-6 and child age 6-12) or 0.1 L (adults) daily at maximum predicted concentration	Ingestion of 0.05 L (child age 2-6 and child age 6-12) or 0.1 L (adults) daily at average predicted concentration
	Soils	Actual (Trespassing)	Incidental Ingestion	Child age 2-6 Child age 6-12 Adult	Ingestion of 200 mg (child age 2-6) or 100 mg (adults and child age 6-12) daily at maximum concentration	Ingestion of 200 mg (child age 2-6) or 100 mg (adults and child age 6-12) daily at average concentration
Dermal	Surface water (Detroit River)	Actual (Recreational)	Casual contact	Child age 2-6	One hour of exposure (20% of body) at maximum concentration	One exposure event (20% of body) per day, 10 days/year, at average concentration
				Child age 6-12	Four hours of exposure (20% of body) at maximum concentration	One exposure event (20% of body) per day, 40 days/year, at average concentration
				Adult	Four hours of exposure (10% of body) at maximum concentration	One exposure event (10% of body) per day, 20 days/year, at average concentration
	Soils	Actual (Trespassing)	Casual contact	Child age 2-6	One hour of exposure (10% of body) at maximum concentration	One exposure event (10% of body) per day, 15 days/year at average concentration
				Child age 6-12	Four hours of exposure (10% of body) at maximum concentration	One exposure event (10% of body) per day, 50 days/year at average concentration
				Adult	Four hours of exposure (10% of body) at maximum concentration	One exposure event (10% of body) per day, 20 days/year at average concentration
Inhalation	Surface water (Detroit River)	Actual (Recreational)	Volatilization	Child age 2-6	One hour of exposure at the maximum predicted concentration	One exposure event per day for 15 days/ year at average predicted concentration
				Child age 6-12 Adult	Four hours of exposure at the maximum predicted concentration	One exposure event per day for (40 for child age 6-12 or 20 for adults) days/yr at average predicted concentration
	Soils	Actual (Trespassing)	Vapors	Child age 2-6	One hour of exposure at the maximum calculated concentration	One exposure event per day for 15 days/ year at average calculated concentration
				Child age 6-12 Adult	Four hours of exposure at the maximum calculated concentration	One exposure event per day for (50 for child age 6-12 or 20 for adults) days/yr at average calculated concentration

group are presented in Table 3-10. The resultant intakes from soil and air exposure are given in Appendix K as Table KX-1, where X denotes the area.

Soil concentrations were readily available from the data and did not require calculations. Surface water and air concentrations were not collected for the Site and required calculating prior to determining the resultant intakes. Therefore, only surface water and air calculations are presented below.

Specific Calculations - Surface Water

Since surface water samples were not collected from the Detroit River, it was necessary to estimate the impact of site-related compounds in ground water which potentially discharges into the river and their impact on the river's quality. These calculated surface water concentrations represent worst case conditions because they were developed under the assumption that a ground water intercept system did not exist. In 1984, S.S. Papadopulos and Associates prepared a report entitled "Rate and Direction of Ground Water Flow at the South Works." That investigation determined that "total ground water discharge from the Site is about 30 gallons per minute under average ground water conditions...". Further investigation concluded that "...the discharge from the Site is less than 0.00004 percent of the average discharge rate of the river...".

Surface water concentrations were calculated using the maximum and average ground water concentrations from the seven monitoring wells installed by ERM. These concentrations were converted to surface water estimates using the following equation:

$$SW_{conc} = GW_{conc} * 0.000004$$

The ground water and estimated surface water concentrations are presented in Table 3-11.

Specific Calculations - Air Emissions

To determine potential exposure from volatilized compounds detected in the top four feet of soil, it was necessary to subdivide the Site into areas to expedite the risk calculations. These areas were selected following a thorough review of qualitative and quantitative data and historical information for the Site. Based on this information, samples

Table 3-10
Potential Surface Water Exposure - BASF Corporation - South Works
Wyandotte, Michigan

ROUTE OF EXPOSURE	EXPOSED POPULATION	COMPOUND	MAXIMUM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	AVERAGE CONCENTRATION (PPM)	CHRONIC INTAKE (mg/kg/day)	Weighted Chronic (mg/kg/day)
Inhalation (mg/cub m)	Child age 2-6	Arsenic	1.73E-10	Not volatile	5.44E-11	Not volatile	Not volatile
		Chromium	3.36E-10	Not volatile	1.40E-10	Not volatile	Not volatile
		Copper	1.04E-09	Not volatile	1.36E-10	Not volatile	Not volatile
		Mercury	8.00E-10	Not volatile	1.66E-10	Not volatile	Not volatile
		Nickel	6.32E-10	Not volatile	2.19E-10	Not volatile	Not volatile
		Zinc	2.16E-09	Not volatile	9.94E-10	Not volatile	Not volatile
		Benzene	3.36E-10	7.04E-11	5.51E-11	1.17E-11	6.87E-13
		1,2-Dichloroethane	1.68E-09	3.52E-10	2.42E-10	5.13E-11	3.02E-12
		1.2-Dichloropropane	8.80E-09	1.84E-09	1.26E-08	2.67E-09	1.57E-10
		Trichloroethylene	2.00E-09	4.19E-10	2.87E-10	6.08E-11	3.58E-12
		Vinyl Chloride	1.60E-09	3.35E-10	2.30E-10	4.88E-11	2.87E-12
		PNAs	1.84E-11	Not volatile	6.40E-12	Not volatile	Not volatile
		bis(2-Chloroethyl)ether	1.84E-09	3.86E-10	3.37E-10	7.14E-11	4.20E-12
		bis(2-Chloroisopropyl)ether	1.28E-07	2.68E-08	2.14E-08	4.54E-09	2.67E-10
		PCB 1254	ND	Not volatile	ND	Not volatile	Not volatile
	Child age 6-12	Arsenic	1.73E-10	Not volatile	5.44E-11	Not volatile	Not volatile
		Chromium	3.36E-10	Not volatile	1.40E-10	Not volatile	Not volatile
		Copper	1.04E-09	Not volatile	1.36E-10	Not volatile	Not volatile
		Mercury	8.00E-10	Not volatile	1.66E-10	Not volatile	Not volatile
		Nickel	6.32E-10	Not volatile	2.19E-10	Not volatile	Not volatile
		Zinc	2.16E-09	Not volatile	9.94E-10	Not volatile	Not volatile
		Benzene	3.36E-10	8.55E-11	5.51E-11	1.43E-11	8.43E-13
		1,2-Dichloroethane	1.68E-09	4.27E-10	2.42E-10	6.29E-11	3.70E-12
		1.2-Dichloropropane	8.80E-09	2.24E-09	1.26E-08	3.28E-09	1.93E-10
		Trichloroethylene	2.00E-09	5.09E-10	2.87E-10	7.46E-11	4.39E-12
		Vinyl Chloride	1.60E-09	4.07E-10	2.30E-10	5.98E-11	3.52E-12
		PNAs	1.84E-11	Not volatile	6.40E-12	Not volatile	Not volatile
		bis(2-Chloroethyl)ether	1.84E-09	4.68E-10	3.37E-10	8.76E-11	5.15E-12
		bis(2-Chloroisopropyl)ether	1.28E-07	3.26E-08	2.14E-08	5.56E-09	3.27E-10
		PCB 1254	ND	Not volatile	ND	Not volatile	Not volatile
	Adults	Arsenic	1.73E-10	Not volatile	5.44E-11	Not volatile	Not volatile
		Chromium	3.36E-10	Not volatile	1.40E-10	Not volatile	Not volatile
		Copper	1.04E-09	Not volatile	1.36E-10	Not volatile	Not volatile
		Mercury	8.00E-10	Not volatile	1.66E-10	Not volatile	Not volatile
		Nickel	6.32E-10	Not volatile	2.19E-10	Not volatile	Not volatile
		Zinc	2.16E-09	Not volatile	9.94E-10	Not volatile	Not volatile
		Benzene	3.36E-10	6.38E-11	5.51E-11	1.08E-11	6.35E-13
		1,2-Dichloroethane	1.68E-09	3.19E-10	2.42E-10	4.74E-11	2.79E-12
		1.2-Dichloropropane	8.80E-09	1.67E-09	1.26E-08	2.47E-09	1.45E-10
		Trichloroethylene	2.00E-09	3.80E-10	2.87E-10	5.63E-11	3.31E-12
		Vinyl Chloride	1.60E-09	3.04E-10	2.30E-10	4.51E-11	2.65E-12
		PNAs	1.84E-11	Not volatile	6.40E-12	Not volatile	Not volatile
		bis(2-Chloroethyl)ether	1.84E-09	3.49E-10	3.37E-10	6.61E-11	3.89E-12
		bis(2-Chloroisopropyl)ether	1.28E-07	2.43E-08	2.14E-08	4.19E-09	2.47E-10
		PCB 1254	ND	Not volatile	ND	Not volatile	Not volatile

Table 3-10
Potential Surface Water Exposure - BASF Corporation - South Works
Wyandotte, Michigan

ROUTE OF EXPOSURE	EXPOSED POPULATION	COMPOUND	MAXIMUM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	AVERAGE CONCENTRATION (PPM)	CHRONIC INTAKE (mg/kg/day)	Weighted Chronic (mg/kg/day)
Dermal Contact	Child age 2-6	Arsenic	8.64E-08	4.48E-17	2.72E-08	7.29E-13	6.43E-14
		Chromium	1.68E-07	8.71E-17	7.00E-08	1.88E-12	1.66E-13
		Copper	5.20E-07	2.70E-16	6.80E-08	1.82E-12	1.61E-13
		Mercury	4.00E-07	2.07E-16	8.32E-08	2.23E-12	1.97E-13
		Nickel	3.16E-07	1.64E-16	1.09E-07	2.92E-12	2.58E-13
		Zinc	1.08E-06	5.60E-16	4.97E-07	1.33E-11	1.18E-12
		Benzene	1.68E-07	4.96E-12	2.76E-08	7.40E-13	6.53E-14
		1,2-Dichloroethane	8.40E-07	2.48E-11	1.21E-07	3.24E-12	2.86E-13
		1,2-Dichloropropane	4.40E-05	1.30E-09	6.29E-08	1.69E-12	1.49E-13
		Trichloroethylene	1.00E-06	2.95E-11	1.44E-07	3.86E-12	3.41E-13
		Vinyl Chloride	8.00E-07	2.36E-11	1.15E-07	3.08E-12	2.72E-13
		PNAs	9.20E-09	4.77E-18	3.20E-09	8.58E-14	7.57E-15
		bis(2-Chloroethyl)ether	9.20E-07	1.13E-10	1.69E-07	4.53E-12	4.00E-13
		bis(2-Chloroisopropyl)ether	6.40E-05	7.83E-09	1.07E-05	2.87E-10	2.53E-11
		PCB 1254	ND	0.00E+00	ND	0.00E+00	0.00E+00
	Child age 6-12	Arsenic	8.64E-08	3.71E-17	2.72E-08	2.21E-14	1.95E-15
		Chromium	1.68E-07	7.21E-17	7.00E-08	5.70E-14	5.03E-15
		Copper	5.20E-07	2.23E-16	6.80E-08	5.53E-14	4.88E-15
		Mercury	4.00E-07	1.72E-16	8.32E-08	6.77E-14	5.97E-15
		Nickel	3.16E-07	1.36E-16	1.09E-07	8.87E-14	7.82E-15
		Zinc	1.08E-06	4.63E-16	4.97E-07	4.04E-13	3.57E-14
		Benzene	1.68E-07	4.21E-12	2.76E-08	1.31E-09	1.16E-10
		1,2-Dichloroethane	8.40E-07	2.10E-11	1.21E-07	5.74E-09	5.07E-10
		1,2-Dichloropropane	4.40E-05	1.10E-09	6.29E-08	2.99E-09	2.63E-10
		Trichloroethylene	1.00E-06	2.50E-11	1.44E-07	6.83E-09	6.03E-10
		Vinyl Chloride	8.00E-07	2.00E-11	1.15E-07	5.46E-09	4.82E-10
		PNAs	9.20E-09	3.95E-18	3.20E-09	2.60E-15	2.30E-16
		bis(2-Chloroethyl)ether	9.20E-07	9.32E-11	1.69E-07	3.25E-08	2.86E-09
		bis(2-Chloroisopropyl)ether	6.40E-05	6.48E-09	1.07E-05	2.06E-06	1.81E-07
		PCB 1254	ND	0.00E+00	ND	0.00E+00	0.00E+00
	Adults	Arsenic	8.64E-08	5.37E-14	2.72E-08	1.69E-14	1.49E-15
		Chromium	1.68E-07	1.04E-13	7.00E-08	4.35E-14	3.84E-15
		Copper	5.20E-07	3.23E-13	6.80E-08	4.23E-14	3.73E-15
		Mercury	4.00E-07	2.49E-13	8.32E-08	5.17E-14	4.56E-15
		Nickel	3.16E-07	1.96E-13	1.09E-07	6.77E-14	5.98E-15
		Zinc	1.08E-06	6.71E-13	4.97E-07	3.09E-13	2.72E-14
		Benzene	1.68E-07	6.09E-09	2.76E-08	1.00E-09	8.83E-11
		1,2-Dichloroethane	8.40E-07	3.04E-08	1.21E-07	4.39E-09	3.87E-10
		1,2-Dichloropropane	4.40E-05	1.59E-06	6.29E-08	2.28E-09	2.01E-10
		Trichloroethylene	1.00E-06	3.62E-08	1.44E-07	5.22E-09	4.61E-10
		Vinyl Chloride	8.00E-07	2.90E-08	1.15E-07	4.17E-09	3.68E-10
		PNAs	9.20E-09	5.72E-15	3.20E-09	1.99E-15	1.75E-16
		bis(2-Chloroethyl)ether	9.20E-07	1.35E-07	1.69E-07	2.48E-08	2.19E-09
		bis(2-Chloroisopropyl)ether	6.40E-05	9.39E-06	1.07E-05	1.57E-06	1.39E-07
		PCB 1254	ND	0.00E+00	ND	0.00E+00	0.00E+00

Table 3-10
Potential Surface Water Exposure - BASF Corporation - South Works
Wyandotte, Michigan

ROUTE OF EXPOSURE	EXPOSED POPULATION	COMPOUND	MAXIMUM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	AVERAGE CONCENTRATION (PPM)	CHRONIC INTAKE (mg/kg/day)	Weighted Chronic (mg/kg/day)
Incidental Ingestion	Child age 2-6	Arsenic	8.64E-08	2.70E-09	2.72E-08	8.49E-10	7.24E-10
		Chromium	1.68E-07	5.25E-09	7.00E-08	2.18E-09	1.86E-09
		Copper	5.20E-07	1.63E-08	6.80E-08	2.12E-09	1.81E-09
		Mercury	4.00E-07	1.25E-08	8.32E-08	2.60E-09	2.21E-09
		Nickel	3.16E-07	9.88E-09	1.09E-07	3.40E-09	2.90E-09
		Zinc	1.08E-06	3.38E-08	4.97E-07	1.55E-08	1.32E-08
		Benzene	1.68E-07	5.25E-09	2.76E-08	8.61E-10	7.34E-10
		1,2-Dichloroethane	8.40E-07	2.63E-08	1.21E-07	3.78E-09	3.22E-09
		1.2-Dichloropropane	4.40E-05	1.38E-06	6.29E-08	1.96E-09	1.67E-09
		Trichloroethylene	1.00E-06	3.13E-08	1.44E-07	4.49E-09	3.83E-09
		Vinyl Chloride	8.00E-07	2.50E-08	1.15E-07	3.59E-09	3.06E-09
		PNAs	9.20E-09	2.88E-10	3.20E-09	9.98E-11	8.52E-11
		bis(2-Chloroethyl)ether	9.20E-07	2.88E-08	1.69E-07	5.27E-09	4.50E-09
		bis(2-Chloroisopropyl)ether	6.40E-05	2.00E-06	1.07E-05	3.34E-07	2.85E-07
		PCB 1254	ND	0.00E+00	ND	0.00E+00	0.00E+00
	Child age 6-12	Arsenic	8.64E-08	2.97E-09	2.72E-08	9.38E-11	8.00E-11
		Chromium	1.68E-07	5.78E-09	7.00E-08	2.42E-10	2.06E-10
		Copper	5.20E-07	1.79E-08	6.80E-08	2.35E-10	2.00E-10
		Mercury	4.00E-07	1.38E-08	8.32E-08	2.87E-10	2.45E-10
		Nickel	3.16E-07	1.09E-08	1.09E-07	3.76E-10	3.21E-10
		Zinc	1.08E-06	3.72E-08	4.97E-07	1.71E-09	1.46E-09
		Benzene	1.68E-07	5.78E-09	2.76E-08	9.52E-11	8.12E-11
		1,2-Dichloroethane	8.40E-07	2.89E-08	1.21E-07	4.17E-10	3.56E-10
		1.2-Dichloropropane	4.40E-05	1.51E-06	6.29E-08	2.17E-10	1.85E-10
		Trichloroethylene	1.00E-06	3.44E-08	1.44E-07	4.97E-10	4.24E-10
		Vinyl Chloride	8.00E-07	2.75E-08	1.15E-07	3.97E-10	3.38E-10
		PNAs	9.20E-09	3.16E-10	3.20E-09	1.10E-11	9.42E-12
		bis(2-Chloroethyl)ether	9.20E-07	3.16E-08	1.69E-07	5.83E-10	4.97E-10
		bis(2-Chloroisopropyl)ether	6.40E-05	2.20E-06	1.07E-05	3.69E-08	3.15E-08
		PCB 1254	ND	0.00E+00	ND	0.00E+00	0.00E+00
	Adults	Arsenic	8.64E-08	1.23E-09	2.72E-08	3.89E-10	3.32E-10
		Chromium	1.68E-07	2.40E-09	7.00E-08	1.00E-09	8.54E-10
		Copper	5.20E-07	7.43E-09	6.80E-08	9.72E-10	8.29E-10
		Mercury	4.00E-07	5.71E-09	8.32E-08	1.19E-09	1.01E-09
		Nickel	3.16E-07	4.51E-09	1.09E-07	1.56E-09	1.33E-09
		Zinc	1.08E-06	1.54E-08	4.97E-07	7.11E-09	6.06E-09
		Benzene	1.68E-07	2.40E-09	2.76E-08	3.95E-10	3.37E-10
		1,2-Dichloroethane	8.40E-07	1.20E-08	1.21E-07	1.73E-09	1.48E-09
		1.2-Dichloropropane	4.40E-05	6.28E-07	6.29E-08	8.99E-10	7.67E-10
		Trichloroethylene	1.00E-06	1.43E-08	1.44E-07	2.06E-09	1.76E-09
		Vinyl Chloride	8.00E-07	1.14E-08	1.15E-07	1.64E-09	1.40E-09
		PNAs	9.20E-09	1.31E-10	3.20E-09	4.58E-11	3.90E-11
		bis(2-Chloroethyl)ether	9.20E-07	1.31E-08	1.69E-07	2.42E-09	2.06E-09
		bis(2-Chloroisopropyl)ether	6.40E-05	9.14E-07	1.07E-05	1.53E-07	1.31E-07
		PCB 1254	ND	0.00E+00	ND	0.00E+00	0.00E+00

Table 3-11
Ground Water and Estimated Surface Water Concentrations
BASF Corporation - South Works
Wyandotte, Michigan

Compound	Ground Water Concentration (mg/L)		Estimated Surface Water Concentration (mg/L)	
	Maximum	Average	Maximum	Average
Arsenic	2.16E-01	6.80E-02	8.60E-08	2.72E-08
Chromium	4.20E-01	1.75E-01	1.68E-07	7.00E-08
Copper	5.30E-01	1.70E-01	2.12E-07	6.80E-08
Mercury	1.00E+00	2.08E-01	4.00E-07	8.32E-08
Nickel	7.90E-01	2.73E-01	3.16E-07	1.08E-07
Zinc	2.70E+00	1.24E+00	1.08E-06	4.96E-07
Benzene	4.20E-01	6.89E-02	1.68E-07	2.76E-08
1,2-Dichloroethane	2.10E+00	3.02E-01	8.40E-07	1.21E-07
1,2-Dichloropropane	1.10E+02	1.57E+01	4.40E-05	6.28E-08
Trichloroethene	2.50E+00	3.59E-01	1.00E-06	1.44E-07
Vinyl Chloride	2.00E+00	2.88E-01	8.00E-07	1.15E-07
PNAs	2.30E-02	8.00E-03	9.20E-09	3.20E-09
bis(2-Chloroethyl)ether	2.30E+00	4.22E-01	9.20E-07	1.69E-07
bis(2-Chloroisopropyl)ether	1.60E+02	2.68E+01	6.40E-05	1.07E-05

Estimated surface water concentration = ground water concentration * 0.000004
Dilution factor from Papadopulos, et al., 1984

with similar concentration levels and detected compounds were grouped into areas. Figure 3-5 is a map of the areas.

The size of the areas and the maximum and average concentration of compounds within the top four feet of soil were used to calculate compound-specific emission rates. These emission rates were then used to determine an air concentration at the receptor point. The receptor point for each area was taken as the hypothetical trespasser. The detailed text and accompanying equations and tables for the air dispersion modeling are presented in Appendix J.

The assumptions made for the risk calculations are given in Table 3-12 and the calculated air concentrations are presented in Table 3-13. It is important to note that these assumptions govern the remainder of the current and future land use risk assessments. The risks calculated hereafter are valid only if land disturbance does not exceed four feet below land surface. If construction activities are undertaken below a depth of four feet, then a new assessment based on concentrations detected in the deeper soils must be made for those disturbed areas.

3.5 Risk Characterization

3.5.1 Approach

The final component of the RA process is risk characterization. Risk characterization estimates the incidence of potential adverse health or environmental effects under the various exposure conditions. It is performed by integrating information developed during the exposure and toxicity evaluations to yield a complete characterization of risk at a site. The three discrete steps required to develop this characterization are as follows:

1. Comparison with potentially Applicable or Relevant and Appropriate Requirements (ARARs),
2. Characterization of Noncarcinogenic Hazard Index, and
3. Characterization of Carcinogenic Risk.

The risks posed by compounds detected at the Site under current conditions were evaluated at the receptor points. The present concentrations of compounds detected at the Site are at steady-state, as is evident in a comparison of the ground water data collected during this investigation to previous investigations. A discussion of uncertainties encountered in the risk assessment process is included

Table 3-12

Assumptions Used in Calculating Air Emissions
BASF Corporation - South Works
Wyandotte, Michigan

- Excavation alternatives were not considered in this RA
- Only volatile compounds were considered to off-gas from soils
- Fugitive dust emissions were not considered
- Construction worker exposure was not considered
- Four feet under land surface available for volatilization
- Six inches to one foot of clean fill across site
- Inhalation, incidental ingestion, and dermal contact with soils
- Adults, children ages 6-12, and children ages 2-6
- Exposed populations at Biddle Avenue fenceline
- Subsurface (>4 feet) and ground water conditions were not considered
- Air modeling required subdivision of the site into areas
- Air areas were carried through the RA process
- Sixteen areas were modeled
- Farmer's Equation was used for volatilization (EPA, 1989c)
- Soil type is fill material of 50% sand and 50% clay
- Soil moisture is 0.34
- Bulk density is 0.43 g/cm^3
- Screening level model (ISCLT) was used
- 5-year composite set of meteorological data from Detroit
- Urban dispersion coefficients
- Flat terrain

Table 3-13
Modeled Air Concentrations
BASF Corporation - South Works
Wyandotte, Michigan

Chemical	Area 1		Area 2		Area 3		Area 4	
	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)
Toluene			5.60E-02	3.15E-05	1.59E-01	5.26E-05	6.70E-02	3.43E-05
1,2-Dichloroethane					4.40E-02	1.93E-05	1.70E+00	8.68E-04
Trichloroethene	2.20E-01	1.19E-04	2.81E+01	1.59E-02	2.78E+01	1.22E-02	1.18E+01	6.02E-03
1,2-Dichloropropane			4.78E+00	2.69E-03	1.84E+00	8.09E-04	5.80E-02	2.96E-05
Vinyl chloride								
bis(2-Chloroisopropyl)ether					2.80E-01	1.23E-04		
bis(2-Chloroethyl)ether								
1,2-Dichloroethene							3.30E-02	1.68E-05
Benzene								
Tetrachloroethene							5.80E-02	2.96E-05

NOTE:
VOC rate(g/cm2-s)*(area (cm2))= VOC emission rate (g/s)
VOC emission rate(g/s) * Modeled Concentration ((µg/m3)/(g/s)) = VOC concentration (µg/m3)

All data used for the air modeling consisted of laboratory data and/or GC/MS data collected using the FAST™ unit, unless otherwise specified.

ppm = mg/kg

Table 3-13
Modeled Air Concentrations
BASF Corporation - South Works
Wyandotte, Michigan

Chemical	Area 5		Area 6		Area 7		Area 8	
	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)
Toluene	1.20E-01	6.90E-05			9.00E-03	5.50E-06	8.00E-03	4.73E-06
1,2-Dichloroethane	1.43E-01	7.01E-05						
Trichloroethene	1.22E+00	7.01E-04	2.40E-01	1.30E-04				
1,2-Dichloropropane	2.33E-01	1.34E-04			5.60E-01	3.40E-04	9.00E-03	5.37E-07
Vinyl chloride								
bis(2-Chloroisopropyl)ether	7.30E-02	4.22E-05						
bis(2-Chloroethyl)ether			2.50E-01	1.35E-04				
1,2-Dichloroethene	1.22E-01	6.99E-05						
Benzene								
Tetrachloroethene	1.60E-01	9.21E-06						0.00E+00

NOTE:
VOC rate(g/cm2-s)*(area (cm2))= VOC emission rate (g/s)
VOC emission rate(g/s) * Modeled Concentration ((µg/m3)/(g/s)) = VOC concentration (µg/m3)

All data used for the air modeling consisted of laboratory data and/or GC/MS data collected using the FAST™ unit, unless otherwise specified.

ppm = mg/kg

Table 3-13
Modeled Air Concentrations
BASF Corporation - South Works
Wyandotte, Michigan

Chemical	Area 9		Area 10		Area 11		Area 12	
	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (ug/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)
Toluene	4.00E-03	2.24E-06	1.20E-02	6.72E-06	8.00E-03	4.43E-06	6.00E-03	3.41E-06
1,2-Dichloroethane			3.30E-01	1.84E-04	2.10E-02	1.17E-05	3.20E-02	1.81E-05
Trichloroethene					1.30E-02	7.29E-06		
1,2-Dichloropropane	5.00E-03	2.83E-06	1.80E-01	1.00E-04	8.20E-02	4.55E-05	1.70E-01	9.63E-05
Vinyl chloride			3.70E-02	2.07E-05				
bis(2-Chloroisopropyl)ether					2.00E-02	1.23E-05		
bis(2-Chloroethyl)ether								
1,2-Dichloroethene								
Benzene			4.00E-03	2.24E-06	1.00E-02	5.57E-06		
Tetrachloroethene	9.00E-03	5.12E-06	4.00E-03	2.24E-06	1.27E-01	7.05E-05		

NOTE:
VOC rate(g/cm2-s)*(area (cm2))= VOC emission rate (g/s)
VOC emission rate(g/s) * Modeled Concentration ((µg/m3)/(g/s)) = VOC concentration (µg/m3)

All data used for the air modeling consisted of laboratory data and/or GC/MS data collected using the FAST™ unit, unless otherwise specified.

ppm = mg/kg

Table 3-13
Modeled Air Concentrations
BASF Corporation - South Works
Wyandotte, Michigan

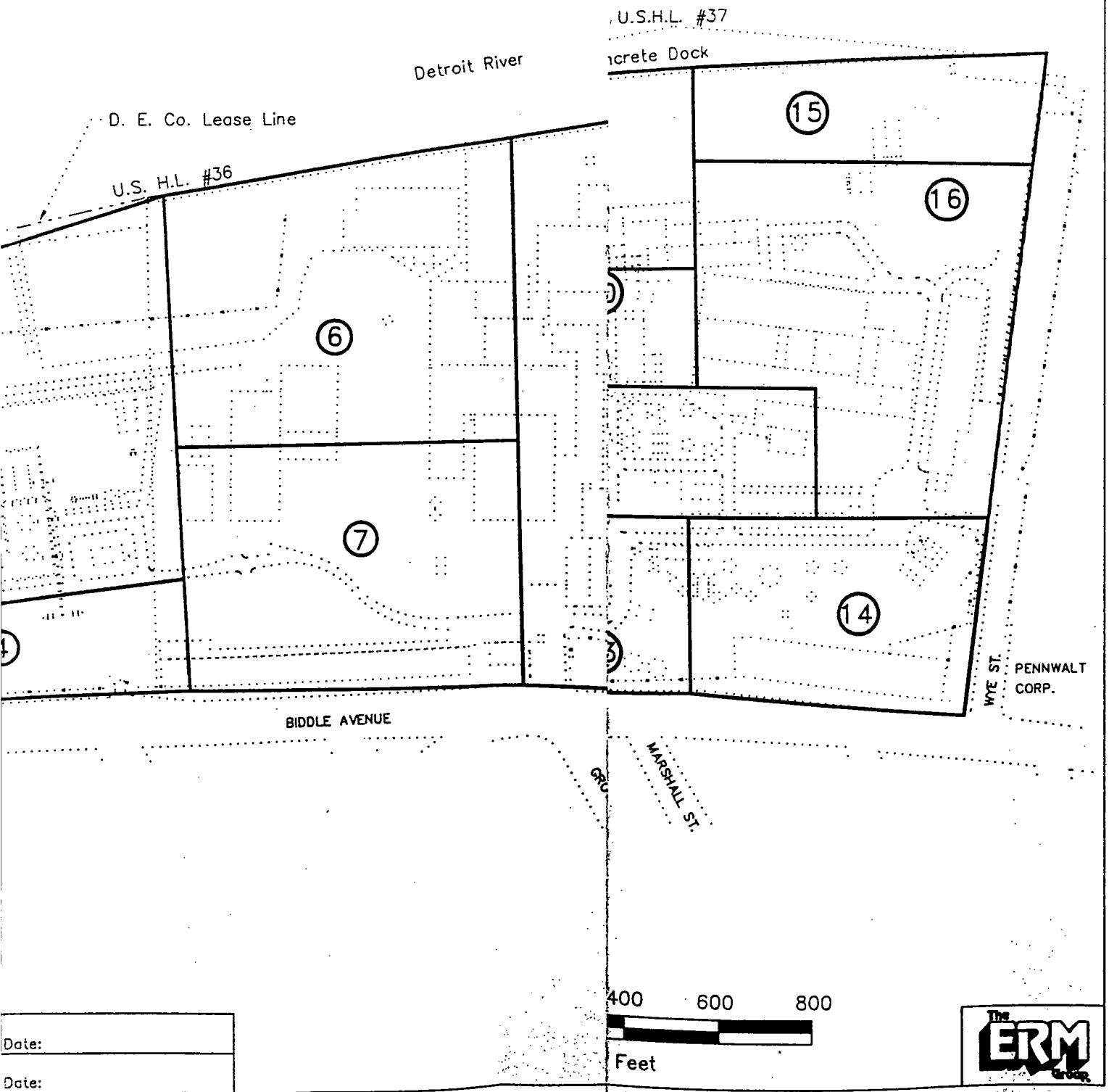
Chemical	Area 13		Area 14		Area 15		Area 16	
	Soil Conc. (ppm)	Air Conc. (ppm)	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)	Soil Conc. (ppm)	Air Conc. (µg/m3)
Toluene	1.00E-02	4.38E-06	1.20E-02	5.85E-06	2.10E-01	1.07E-04	1.40E-02	8.93E-06
1,2-Dichloroethane	9.00E-02	3.97E-05						
Trichloroethene					8.00E-03	4.07E-06	4.00E-03	2.55E-06
1,2-Dichloropropane	6.33E+02	2.78E-01	3.40E-01	1.65E-04	2.60E-02	1.33E-05	2.60E-02	1.66E-05
Vinyl chloride								
bis(2-Chloroisopropyl)ether	7.11E+00	3.12E-03	3.95E+00	1.92E-03				
bis(2-Chloroethyl)ether	2.30E-01	1.01E-04						
1,2-Dichloroethene								
Benzene	7.00E-03	3.07E-06	1.10E-01	5.35E-05				
Tetrachloroethene					2.50E-02	1.28E-05		

NOTE:
VOC rate(g/cm2-s)*(area (cm2))= VOC emission rate (g/s)
VOC emission rate(g/s) * Modeled Concentration ((µg/m3)/(g/s)) = VOC concentration (µg/m3)

All data used for the air modeling consisted of laboratory data and/or GC/MS data collected using the FAST™ unit, unless otherwise specified.

ppm = mg/kg

Figure 3-5
Risk Assessment Areas
or Soil Exposure Pathways
ASF Corporation - South Works
Wyandotte, Michigan



Date:

Date:

in this section to provide a perspective in interpreting the results of the assessment.

3.5.2 Comparison to Potentially Applicable or Relevant and Appropriate Requirements (ARARs)

Standards and guidelines for compounds are determined by the exposure pathways. A detailed discussion of legally applicable, relevant and appropriate, and TBC (to-be-considered) criteria is presented in Appendix I. For many of the compounds detected at the South Works Site, promulgated standards or guidelines do not exist. The following is a summary of the ARARS by medium:

MEDIUM	ARAR
Soil	- EPA Lead and PCB Standard
Sediment	- No ARARs
Air	- No Applicable ARARs
Surface Water	- EPA Ambient Water Quality Criteria (AWQC)
	- Michigan Water Quality Criteria
	- EPA Maximum Contaminant Levels (MCLs)

A comparison of levels of compounds detected in surface water and soils to potential ARARs is presented in Tables 3-14 and 3-15. None of the estimated surface water concentrations exceeded EPA MCLs, EPA Ambient Water Quality Criteria, or Michigan Water Quality Standards. For the soil samples, a background sample (P-15) was collected from 0 to 2.5 feet below ground surface. The concentration of organic and inorganic compounds in the background soil sample and Michigan soil ranges are also given on Table 3-15. The actual concentrations of some compounds exceeded their respective soil standards. EPA's maximum lead guideline of 1,000 ppm was exceeded by the maximum subsurface soil concentration.

3.5.3 Noncarcinogenic Hazard Index

As described in Appendix I, the hazard index for noncarcinogens is the ratio of the calculated potential intake to acceptable intakes. EPA's guidelines for noncarcinogenic effects is one, or the ratio of the calculated intake to an accepted intake. Values of less than one indicate that a hazard does not exist. A value greater than one indicates that a hazard may exist. Both chronic and subchronic

Table 3-14
Comparison of Actual Concentrations of Compounds
with Surface Water ARARs
BASF Corporation - South Works
Wyandotte, Michigan
(concentrations in mg/L except where noted)

Compound	MAX	AVE	EPA MCL STANDARD	EPA AWQC Acute/Chronic Toxicity	EPA AWQC Ingestion of Organisms/Water	EPA AWQC Ingestion of Organisms Only	Michigan Standard (µg/g) Water	Michigan Standard (µg/g) Fish
Arsenic	8.64E-08	2.72E-08	0.05	0.360/0.190	2.20E-06	1.75E-05	0.5	
Beryllium	2.80E-09	1.80E-09		0.13 / 0.0053	3.70E-06	6.41E-05		
Calcium	3.26E-04	1.93E-04		VERY HARD WATER				
Chromium	1.68E-07	7.00E-08	0.05	2.222 / 1.025	1.70E+02	3.43E+03	0.05	
Copper	2.12E-07	6.80E-08	1.3	0.0167 / 0.00387	1 (organoleptic)	none	0.005	
Iron	4.08E-05	1.67E-05	0.3	VERY HARD WATER	3.00E-01	1.00E+00		
Lead	1.60E-07	8.67E-08	0.05	0.142 / 0.0123	5.00E-02	5.00E-02	0.01 - 0.025	
Magnesium	6.08E-05	1.89E-05		VERY HARD WATER				
Manganese	1.36E-06	5.69E-07	0.3	none	5.00E-02	1.00E-01	0.001	0.5
Mercury	4.00E-07	8.32E-08	0.002	0.0022 / < 0.00007	1.44E-04	1.46E-04	0.025	
Nickel	3.16E-07	1.09E-07	P	3.1 / 0.160	6.32E-01	4.77E+00		
Potassium	2.01E-05	7.07E-06						
Selenium	3.60E-09	2.72E-09	0.01	0.260 / 0.035	1.00E-02	none	0.01	
Sodium	4.08E-03	8.77E-04						
Zinc	1.08E-06	4.97E-07	5	0.570 / 0.047	5 (organoleptic)	none	0.03	
Benzene	1.68E-07	2.76E-08	0.005	5.3 / -	6.60E-04	4.00E-02		
Chlorobenzene	1.12E-07	1.70E-08	0.1	0.250 / -	4.88E-01	0.02(organoleptic)		
Chloroform	3.88E-07	5.81E-08	0.1	28.9 / 1.24	1.90E-04	1.57E-02		
1,1-Dichloroethane	3.20E-08	5.44E-09	P	none	none	none		
1,2-Dichloroethane	8.40E-07	1.21E-07	0.005	118 / 20	9.40E-04	2.43E-01		
1,1-Dichloroethene	3.60E-09	1.36E-09	0.007	11.6 / -	3.30E-05	1.85E-03		
trans-1,2-Dichloroethene	5.60E-08	8.84E-09	P	11.6 / -	none	none		
1,2-Dichloropropane	4.40E-05	6.29E-06	P	23 / 5.7	none	none		
Ethylbenzene	1.12E-08	2.44E-09	P	32 / -	1.40E+00	3.28E+00		
Methylene Chloride	3.68E-08	6.12E-09	P	11 / -	1.90E-04	1.57E-02		
Tetrachloroethene	5.20E-09	1.60E-09	P	5.28 / 0.840	8.00E-04	8.85E-03		
Toluene	2.68E-08	4.68E-09	P	17.5 / -	1.43E+01	4.24E+02		
Trichloroethene	1.00E-06	1.44E-07	0.005	45 / -	2.70E-03	8.07E-02		
Vinyl chloride	8.00E-07	1.15E-07	0.002	none	2.00E-03	5.25E-01		
bis(2-Chloroethyl)ether	9.20E-07	1.69E-07		238 / -	3.00E-05	1.36E-03		
bis(2-Chloroisopropyl)ether	6.40E-05	1.07E-05		238 / -	3.47E-02	4.36E+00		
p-Chloro-m-cresol	1.16E-08	4.00E-09						
1,2-Dichlorobenzene	1.72E-08	4.52E-09	P	1.12 / 0.763	4.00E-01	2.60E+00		
1,4-Dichlorobenzene	2.28E-08	5.48E-09	0.75	1.12 / 0.763	4.00E-01	2.60E+00		
Phenol	2.68E-08	6.48E-09	P	10.2 / 2.56	3.50E+00	none		
Pyrene	9.20E-09	3.20E-09		none	2.80E-06	3.11E-05		

P - Proposed drinking water standard, but not promulgated.

Table 3-15
Comparison of Actual Concentrations of Compounds with Soil ARARs
BASF Corporation - South Works
Wyandotte, Michigan
(concentrations in mg/kg or ppm)

Compound	Maximum Soil Concentration (0-4 ft.)	EPA Standard	Michigan Soils	Site* Background	Michigan Type B Cleanup Criteria
Arsenic	148		0.7 - 15.9	10	0.0004
Lead	3110	500 - 1000	6 - 56	28	
Mercury	172		0.04 - 0.50	0.35	
Benzene	0.315				
Carbon Tetrachloride	0.023				
Chlorobenzene	0.022				0.02
Chloroform	3.35			0.009	2.8
1,2-Dichloroethane	6.801				0.120
1,2-Dichloroethene	0.8				
1,2-Dichloropropane	1860			0.011	0.008
Ethylbenzene	0.109				0.6
Methylene Chloride	0.091				0.1
Tetrachloroethene	0.368				0.014
Toluene	0.584				
Trichloroethene	112.2				0.060
Trichlorofluormethane	0.11				
Vinyl Chloride	0.141				0.0004
PNAs (A, B1, B2 carcinogens)	73.355				0.1
PCBs	20.11	10	Site-Specific		1.0
bis(2-Chloroisopropyl)ether	0.37				
bis(2-Chloroethyl)ether	21				
Fluoranthene	18.18				
Fluorene	8.33				
1-Methylnaphthalene	2.06				
2-Methylnaphthalene	2.55				
Naphthalene	73.5				
Phenanthrene	5.3				
Pyrene	2.14				

Blanks indicate nondetectable concentrations
*Sample P-15 is background sample

intakes were used to calculate the hazard indices. The chronic hazard index was weighted to account for a lifetime of exposure. Two hazard indices were as follows:

- Subchronic hazard index (subchronic intake/subchronic daily intake); and
- Weighted chronic hazard index (weighted chronic intake/ reference dose).

Surface Water

Subchronic and chronic exposure for adults and children 6-12 were incidental ingestion and dermal contact with the Detroit River and inhalation of volatilized compounds estimated for the River in Section 3.4.7. The assessment of the noncarcinogenic hazard is shown in Table 3-16. Hazard indices for subchronic and weighted chronic cases were 3.66×10^{-3} and 2.02×10^{-5}, respectively. The hazard indices for existing conditions at the Site are more than two orders of magnitude below EPA's guideline.

Soils and Air

Subchronic and chronic exposures for adults, children 6-12, and children 2-6 were dermal contact with soils; inhalation of vapors and volatilized compounds from soils; and incidental ingestion of soils. The noncarcinogenic hazards for the areas are presented in Appendix K. The hazard indices for subchronic and weighted chronic cases are summarized in Table 3-17. All hazard indices were less than EPA's guideline even under the worst-case assumptions employed here.

3.5.4 Carcinogenic Risk

As described in Appendix I, the carcinogenic risk is the route-specific intake multiplied by the compound-specific slope factor. EPA's recommended guideline for cancer risk is 1×10^{-4} to 1×10^{-6}, with a target value set at 1×10^{-6}. This target value means one excess cancer could occur for every million people exposed. These slope factors are based on a 95 percent upper confidence limit of the carcinogenic potency of the compound. That is, only a five percent chance exists that the probability of a response could be greater than the estimated value on the basis of the experimental data used. Predicted risk may overestimate the actual risk at a site, but this method is used so that the carcinogenic risk is not underestimated.

TABLE 3-16
Assessment of Noncarcinogenic Effects for Surface Water Only
BASF Corporation - South Works
Wyandotte, Michigan

ROUTE OF EXPOSURE	EXPOSED POPULATION	COMPOUND	SI (mg/kg/day)	AIS + (mg/kg/day)	SI/AIS	CI (mg/kg/day)	RfD + (mg/kg/day)	CI/RfD
Inhalation	Child age 2-6	Chromium	Not volatile	5.10E-03	0.00E+00	Not volatile	5.10E-03	0.00E+00
		Copper	Not volatile	3.70E-03	0.00E+00	Not volatile	3.70E-02	0.00E+00
		Mercury	Not volatile	5.10E-05	0.00E+00	Not volatile	5.10E-05	0.00E+00
		Zinc	Not volatile	none	0.00E+00	Not volatile	2.00E-01	0.00E+00
		bis(2-Chloroisopropyl)ether	2.68E-08	none	0.00E+00	2.67E-10	4.00E-02	6.67E-09
	Child age 6-12	Chromium	Not volatile	5.10E-03	0.00E+00	Not volatile	5.10E-03	0.00E+00
		Copper	Not volatile	3.70E-03	0.00E+00	Not volatile	3.70E-02	0.00E+00
		Mercury	Not volatile	5.10E-05	0.00E+00	Not volatile	5.10E-05	0.00E+00
		Zinc	Not volatile	none	0.00E+00	Not volatile	2.00E-01	0.00E+00
		bis(2-Chloroisopropyl)ether	3.26E-08	none	0.00E+00	3.27E-10	4.00E-02	8.18E-09
	Adults	Chromium	Not volatile	5.10E-03	0.00E+00	Not volatile	5.10E-03	0.00E+00
		Copper	Not volatile	3.70E-03	0.00E+00	Not volatile	3.70E-02	0.00E+00
		Mercury	Not volatile	5.10E-05	0.00E+00	Not volatile	5.10E-05	0.00E+00
		Zinc	Not volatile	none	0.00E+00	Not volatile	2.00E-01	0.00E+00
		bis(2-Chloroisopropyl)ether	2.43E-08	none	0.00E+00	2.47E-10	4.00E-02	6.17E-09
				Total Inhalation Index=	0.00E+00		***Total Inhalation Index=***	2.10E-08
Dermal Contact	Child age 2-6	Chromium	8.71E-17	1.00E-01	8.71E-16	1.66E-13	1.00E+00	1.41E-13
		Copper	2.70E-16	3.70E-03	7.29E-14	1.61E-13	3.70E-02	3.71E-12
		Mercury	2.07E-16	2.00E-03	1.04E-13	1.97E-13	2.00E-03	8.39E-11
		Nickel	1.64E-16	2.00E-02	8.19E-15	2.58E-13	2.00E-02	1.10E-11
		Zinc	5.60E-16	2.00E-01	2.80E-15	1.18E-12	2.00E-01	5.01E-12
		bis(2-Chloroisopropyl)ether	7.83E-09	4.00E-03	1.96E-06	2.53E-11	4.00E-02	5.40E-10
	Child age 6-12	Chromium	7.21E-17	1.00E-01	7.21E-16	5.03E-15	1.00E+00	4.29E-15
		Copper	2.23E-16	3.70E-03	6.03E-14	4.88E-15	3.70E-02	1.13E-13
		Mercury	1.72E-16	2.00E-03	8.58E-14	5.97E-15	2.00E-03	2.55E-12
		Nickel	1.36E-16	2.00E-02	6.78E-15	7.82E-15	2.00E-02	3.34E-13
		Zinc	4.63E-16	2.00E-01	2.32E-15	3.57E-14	2.00E-01	1.52E-13
		bis(2-Chloroisopropyl)ether	6.48E-09	4.00E-03	1.62E-06	1.81E-07	4.00E-02	3.87E-06
	Adults	Chromium	1.04E-13	1.00E-01	1.04E-12	3.84E-15	1.00E+00	3.27E-15
		Copper	3.23E-13	3.70E-03	8.73E-11	3.73E-15	3.70E-02	8.59E-14
		Mercury	2.49E-13	2.00E-03	1.24E-10	4.56E-15	2.00E-03	1.95E-12
		Nickel	1.96E-13	2.00E-02	9.82E-12	5.98E-15	2.00E-02	2.55E-13
		Zinc	6.71E-13	2.00E-01	3.36E-12	2.72E-14	2.00E-01	1.16E-13
		bis(2-Chloroisopropyl)ether	9.39E-06	4.00E-03	2.35E-03	1.39E-07	4.00E-02	2.95E-06
				Total dermal index=	2.35E-03		***Total dermal index=***	6.82E-06
Incidental Ingestion	Child age 2-6	Chromium	5.25E-09	1.00E-01	5.25E-08	1.86E-09	1.00E+00	1.86E-09
		Copper	1.63E-08	3.70E-03	4.39E-06	1.81E-09	3.70E-02	4.89E-08
		Mercury	1.25E-08	2.00E-03	6.25E-06	2.21E-09	2.00E-03	1.11E-06
		Nickel	9.88E-09	2.00E-02	4.94E-07	2.90E-09	2.00E-02	1.45E-07
		Zinc	3.38E-08	2.00E-01	1.69E-07	1.32E-08	2.00E-01	6.61E-08
		bis(2-Chloroisopropyl)ether	2.00E-06	4.00E-03	5.00E-04	2.85E-07	4.00E-02	7.12E-06
	Child age 6-12	Chromium	5.78E-09	1.00E-01	5.78E-08	2.06E-10	1.00E+00	2.06E-10
		Copper	1.79E-08	3.70E-03	4.83E-06	2.00E-10	3.70E-02	5.41E-09
		Mercury	1.38E-08	2.00E-03	6.88E-06	2.45E-10	2.00E-03	1.22E-07
		Nickel	1.09E-08	2.00E-02	5.44E-07	3.21E-10	2.00E-02	1.60E-08
		Zinc	3.72E-08	2.00E-01	1.86E-07	1.46E-09	2.00E-01	7.31E-09
		bis(2-Chloroisopropyl)ether	2.20E-06	4.00E-03	5.50E-04	3.15E-08	4.00E-02	7.87E-07
	Adults	Chromium	2.40E-09	1.00E-01	2.40E-08	8.54E-10	1.00E+00	8.54E-10
		Copper	7.43E-09	3.70E-03	2.01E-06	8.29E-10	3.70E-02	2.24E-08
		Mercury	5.71E-09	2.00E-03	2.86E-06	1.01E-09	2.00E-03	5.07E-07
		Nickel	4.51E-09	2.00E-02	2.26E-07	1.33E-09	2.00E-02	6.65E-08
		Zinc	1.54E-08	2.00E-01	7.71E-08	6.06E-09	2.00E-01	3.03E-08
		bis(2-Chloroisopropyl)ether	9.14E-07	4.00E-03	2.28E-04	1.31E-07	4.00E-02	3.26E-06
				Total ingestion index=	1.31E-03		***Total ingestion index=***	1.33E-05
				Subchronic Hazard =	**3.66E-03**		**Weighted Chronic Hazard =**	**2.02E-05**

Table 3-17
Summary of Reasonable Hazard Analysis for Soil and Air Exposure
Current Site Conditions
BASF Corporation - South Works
Wyandotte, Michigan

Area	A - Current
1	0.00447
2	0.0302
3	0.309
4	0.00943
5	0.0592
6	0
7	0.00632
8	0.00146
9	0.0163
10	0.000361
11	0.00206
12	0.0312
13	0.0181
14	0.00907
15	0.000731
16	0.00528

Target value = 1

Surface Water

An assessment of potential carcinogenic risks for surface water is presented in Table 3-18. Chronic intakes are used to calculate lifetime-weighted carcinogenic risk. Chronic exposure for adults, children 6-12, and children 2-6 involved dermal contact with and incidental ingestion of compounds estimated for the River and inhalation of volatilized compounds. The lifetime-weighted risk for surface water exposure is $3x10^{-8}$, which is more than an order of magnitude lower than EPA's target risk level of $1x10^{-6}$.

Soil and Air

The chronic exposure for adults, children 6-12, and children 2-6 involved dermal contact with soils; inhalation of vapors and volatilized contaminants from exposed soils; and the incidental ingestion of soils. The carcinogenic risk for each area is calculated and presented in Appendix K. The lifetime-weighted risks are summarized in Table 3-19. Figure 3-6 depicts the carcinogenic risk results for each area. The weighted carcinogenic risk for the areas ranged from $1x10^{-3}$ to $8x10^{-9}$. Areas 1, 3, 7, 10, 11, 12, 15, and 16 had carcinogenic risks lower than $1x10^{-6}$. The remaining areas exceeded the $1x10^{-6}$ risk level, with only Area 6 exceeding the $1x10^{-4}$ risk level. The compound responsible for these exceeding the $1x10^{-4}$ risk level in Area 6 was bis(2-chloroethyl)ether.

These risk values were determined for hypothetical trespassers who spend time on the Site. These risk values are significantly less for the residential and commercial population located adjacent to the Site because the neighboring areas are not directly exposed to compounds in the Site soils and are located further from the source areas.

3.5.5 Risk Perspective

Exposure to site-related compounds estimated for the Detroit River does not pose a threat to human health and the environment. It is important to note that EPA's methodology for calculating risk is based upon a set of conservative assumptions and does not provide an accurate estimate of risk, but rather a probability that risk will not exceed the derived estimate. The uncertainty inherent in EPA's methodology is described in Appendix I. In addition, the levels of compounds detected at the Site tend to overestimate the exposure point concentration at a receptor.

TABLE 3-18
Assessment of Carcinogenic Risks for Surface Water Only
BASF Corporation - South Works
Wyandotte, Michigan

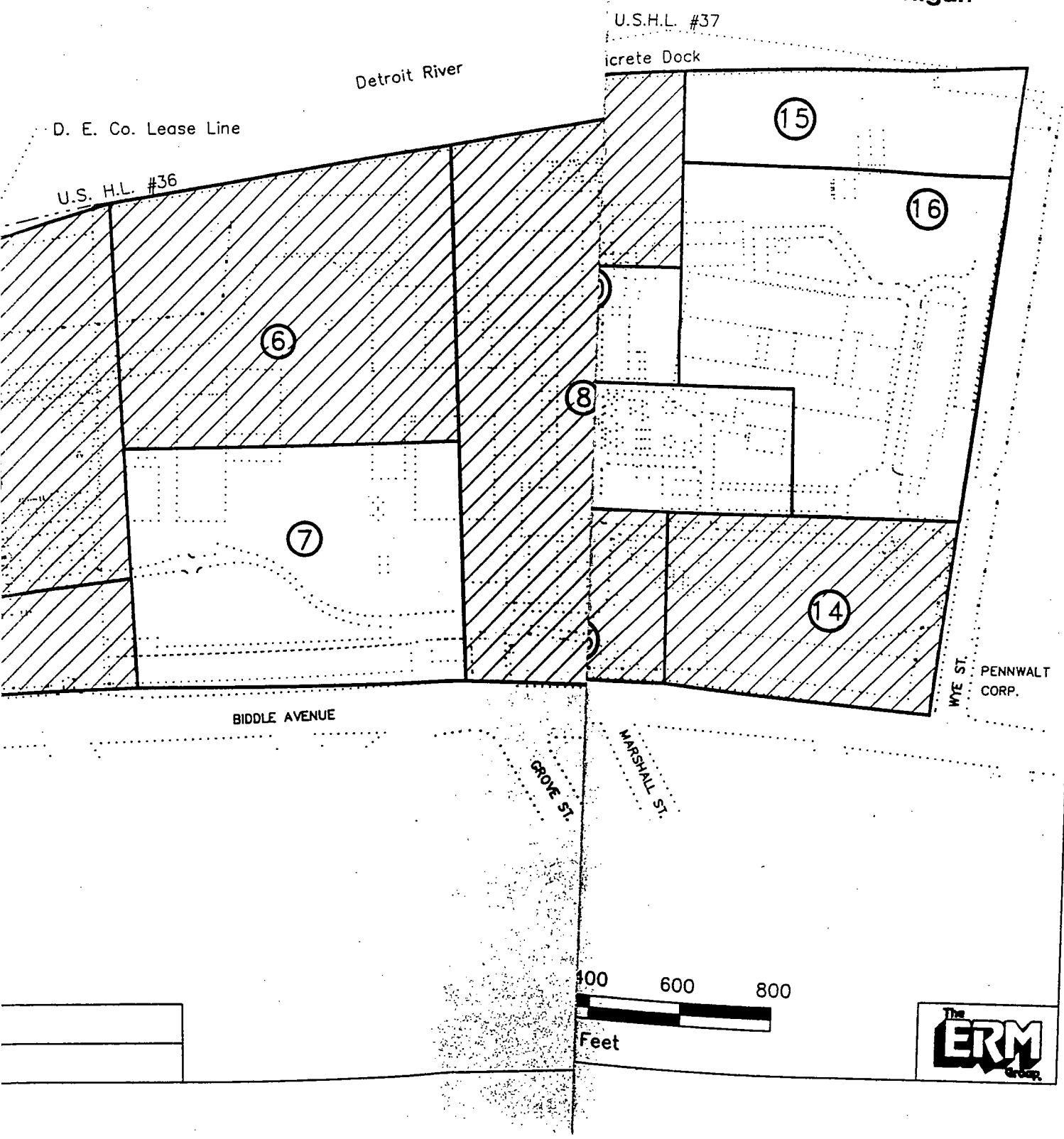
ROUTE OF EXPOSURE	EXPOSED POPULATION	INDICATOR	CI (mg/kg/day)	Slope Factor (mg/kg/day)	CI * SF
Inhalation	Child age 2-6	Arsenic	Not volatile	5.00E+01	0 E+00
		Nickel	Not volatile	8.40E-01	0 E+00
		Benzene	6.87E-13	2.90E-02	2 E-14
		1,2-Dichloroethane	3.02E-12	9.10E-02	3 E-13
		1,2-Dichloropropane	1.57E-10	none	0 E+00
		Trichloroethylene	3.58E-12	1.70E-06	6 E-18
		Vinyl Chloride	2.87E-12	2.95E-01	8 E-13
		bis(2-Chloroethyl)ether	2.67E-10	1.10E+00	3 E-10
	Child age 6-12	Arsenic	Not volatile	5.00E+01	0 E+00
		Nickel	Not volatile	8.40E-01	0 E+00
		Benzene	8.43E-13	2.90E-02	2 E-14
		1,2-Dichloroethane	3.70E-12	9.10E-02	3 E-13
		1,2-Dichloropropane	1.93E-10	none	0 E+00
		Trichloroethylene	4.39E-12	1.70E-06	7 E-18
		Vinyl Chloride	3.52E-12	2.95E-01	1 E-12
		bis(2-Chloroethyl)ether	3.27E-10	1.10E+00	4 E-10
	Adults	Arsenic	Not volatile	5.00E+01	0 E+00
		Nickel	Not volatile	8.40E-01	0 E+00
		Benzene	6.35E-13	2.90E-02	2 E-14
		1,2-Dichloroethane	2.79E-12	9.10E-02	3 E-13
		1,2-Dichloropropane	1.45E-10	none	0 E+00
		Trichloroethylene	3.31E-12	1.70E-06	6 E-18
		Vinyl Chloride	2.65E-12	2.95E-01	8 E-13
		bis(2-Chloroethyl)ether	2.47E-10	1.10E+00	3 E-10
				Total Inhalation Risk =	***9 E-10***
Dermal Contact	Child age 2-6	Arsenic	6.43E-14	1.75E+00	1 E-13
		Benzene	6.53E-14	2.90E-02	2 E-15
		1,2-Dichloroethane	2.86E-13	9.10E-02	3 E-14
		1,2-Dichloropropane	1.49E-13	6.80E-02	1 E-14
		Trichloroethylene	3.41E-13	1.10E-02	4 E-15
		Vinyl Chloride	2.72E-13	2.30E+00	6 E-13
		bis(2-Chloroethyl)ether	4.00E-13	1.10E+00	4 E-13
	Child age 6-12	Arsenic	1.95E-15	1.75E+00	3 E-15
		Benzene	1.16E-10	2.90E-02	3 E-12
		1,2-Dichloroethane	5.07E-10	9.10E-02	5 E-11
		1,2-Dichloropropane	2.63E-10	6.80E-02	2 E-11
		Trichloroethylene	6.03E-10	1.10E-02	7 E-12
		Vinyl Chloride	4.82E-10	2.30E+00	1 E-09
		bis(2-Chloroethyl)ether	2.86E-09	1.10E+00	3 E-09
	Adults	Arsenic	1.49E-15	1.75E+00	3 E-15
		Benzene	8.83E-11	2.90E-02	3 E-12
		1,2-Dichloroethane	3.87E-10	9.10E-02	4 E-11
		1,2-Dichloropropane	2.01E-10	6.80E-02	1 E-11
		Trichloroethylene	4.61E-10	1.10E-02	5 E-12
		Vinyl Chloride	3.68E-10	2.30E+00	8 E-10
		bis(2-Chloroethyl)ether	2.19E-09	1.10E+00	2 E-09
				Total Dermal Risk =	***8 E-09***
Incidental Ingestion	Child age 2-6	Arsenic	7.24E-10	1.75E+00	1 E-09
		Benzene	7.34E-10	2.90E-02	2 E-11
		1,2-Dichloroethane	3.22E-09	9.10E-02	3 E-10
		1,2-Dichloropropane	1.67E-09	6.80E-02	1 E-10
		Trichloroethylene	3.83E-09	1.10E-02	4 E-11
		Vinyl Chloride	3.06E-09	2.30E+00	7 E-09
		bis(2-Chloroethyl)ether	4.50E-09	1.10E+00	5 E-09
	Child age 6-12	Arsenic	8.00E-11	1.75E+00	1 E-10
		Benzene	8.12E-11	2.90E-02	2 E-12
		1,2-Dichloroethane	3.56E-10	9.10E-02	3 E-11
		1,2-Dichloropropane	1.85E-10	6.80E-02	1 E-11
		Trichloroethylene	4.24E-10	1.10E-02	5 E-12
		Vinyl Chloride	3.38E-10	2.30E+00	8 E-10
		bis(2-Chloroethyl)ether	4.97E-10	1.10E+00	5 E-10
	Adults	Arsenic	3.32E-10	1.75E+00	6 E-10
		Benzene	3.37E-10	2.90E-02	1 E-11
		1,2-Dichloroethane	1.48E-09	9.10E-02	1 E-10
		1,2-Dichloropropane	7.67E-10	6.80E-02	5 E-11
		Trichloroethylene	1.76E-09	1.10E-02	2 E-11
		Vinyl Chloride	1.40E-09	2.30E+00	3 E-09
		bis(2-Chloroethyl)ether	2.06E-09	1.10E+00	2 E-09
				Total Ingestion Risk =	***2 E-08***
				Carcinogenic Risk =	**3 E-08**

Table 3-19
Summary of Risk Analysis for Soil and Air Exposures
Current Site Conditions*
BASF Corporation - South Works
Wyandotte, Michigan

Area	A - Current
1	8E-09
2	**1E-05**
3	5E-07
4	**2E-06**
5	**2E-06**
6	***1E-03***
7	1E-06
8	**2E-06**
9	**8E-06**
10	2E-07
11	3E-08
12	6E-07
13	**7E-06**
14	**4E-06**
15	6E-07
16	8E-09

Bold indicates exceeds 1E-06
Italic indicates exceeds 1E-04
Target value = 1E-06
*Hypothetical trespasser is potentially exposed population.

Figure 3-6
Risk Assessment Areas or Soil Exposure Pathways Current Site Conditions Based on Assumptions in Tables 3-7 and 3-12
ASF Corporation - South Works
Wyandotte, Michigan



In order to put the calculated risk and hazard values into perspective, consideration was given to the following:

- Conservative health-based assumptions were used in the derivation of all quantitative risks;
- Residents in areas adjacent to the Site were not evaluated as a potentially exposed population because the greatest exposure occurs from actual contact with the Site soils. Unless a person physically trespasses on the Site, the exposures and subsequent risks from residing near the South Works Site is significantly less than the trespasser. That is, the potential risks to the residential and commercial communities near the Site would be below the 1×10^{-6} optimum risk level used by EPA;
- The Detroit River adjacent to the Site is not used extensively for recreational (i.e., swimming) activities to the best of our knowledge; although heavy fishing activities do occur on the River. Therefore, the assumptions used for recreational scenarios were conservative and may have over-estimated the actual risks posed by contaminants, if any, that enter the Detroit River from the Site. Additionally, the estimated surface water concentrations were based on maximum concentrations of ground water sampling results. This estimation did not consider biodegradation or the presence of the recovery well systems which would further reduce the flow of contaminants to the River;
- A recreational population was evaluated for potential exposures on the Detroit River, while trespassers were evaluated as the exposed population for the Site;
- Ground water underlying the Site is not used and could not be suitable for human use, regardless of the present ground water quality because 1) the fill material has a very low water yield, 2) underlying bedrock aquifer has high sulfide concentrations that restrict its use, and 3) potable water is readily available through the City of Wyandotte;
- The concentrations used in the air exposure pathways represented conditions up to four feet below land surface. Any air exposure to this depth of contaminated soil is unlikely; and
- Construction activities that might expose soils to a depth greater than four feet below land surface do not occur.

SECTION 4
ENVIRONMENTAL ASSESSMENT

4.1 Site Walkover

The environmental assessment was performed to augment the human health risk assessment. It consisted of a site walkover, determination of endangered species, protection of the Detroit River, and recreational use of the Detroit River. These components are described below.

A site walkover was conducted by experienced biologists. Vegetation present on the Site was homogeneously distributed and of low diversity. Plant species in open field areas consisted primarily of pioneering grass and weeds (i.e., clover, wild carrot, plantain, dandelion, and wild strawberry). The open field appears to have been originally seeded with grass, but has since been invaded by pioneering weed species. Open field growth is patchy and appears to be very stressed (i.e., stunted growth).

The only shrub and tree species on site are planted ornamental varieties: cedar and chinese elm. The highest diversity of vegetation appears along the shoreline, but consists primarily of invading stress tolerant weed species (i.e., American elm, cottonwood, tree-of-heaven, box elder, willow, dogwood, goldenrod, asters, red-osier, gray dogwood, sumac, deadly night shade, reed grass, wild grape, and wild rose).

Wildlife usage of the property appeaed to be primarily avian: gulls, Canada Geese, and mourning doves. No active or abandoned bird nests were noted in the few shrub and tree species on site. The only evidence of other wildlife use of the property was one woodchuck burrow. No other visual evidence (i.e., scats or tracks) of wildlife use was noted. Overall, site conditions were not desirable for habitat because of low cover and food sources. Aquatic faunal use of the property could not be assessed due to the season (i.e., winter); however, the shoreline habitat (i.e. concrete breakwall, bulkheads, and rip-rap) was not considered an attractive habitat for such species.

Wetland habitats or other environmentally sensitive habitats were not found on the Site. Rare, threatened, or endangered plant or animal species were not observed on site.

4.2 Endangered Species Determination

Michigan Natural Features Inventory database indicated the following natural features at or within the vicinity of the Site:

- *Strophostyles helvula* - State special concern plant was last observed in 1914 in this area based on an ancient record concerning Grosse Isle. The species may still occur in nearby wet areas (i.e., ditches, wet meadows, sandy shores, etc.).
- *Obovaria subrotunda* - State threatened animal was last observed pre-1930 based on an ancient record concerning the Detroit River. This species still exists in nearby rivers. A survey for this clam should be instituted if waterway development is proposed.

4.3 Environmental Summary

The results of the environmental assessment for the Site indicated little impact on terrestrial or aquatic flora and fauna resulting from the compounds detected. Surface water concentrations are significantly lower than either EPA Ambient Water Quality Criteria or Michigan Water Quality Standards. Vegetation at the Site is sparse. There are no indications of endangered species at the Site.

SECTION 5
RISK ASSESSMENT - FUTURE LAND USE

5.1 Approach

The risk assessment for future land use followed the same steps as discussed in Section 3 for the current Site conditions. The differences between the two are the exposure assumptions which are discussed below and the RA approach, as denoted in Figure 3-2.

The City of Wyandotte Zoning Ordinance identified 15 future land use categories. These categories were examined for exposures specific to each category type. Zoning categories with similar exposure scenarios were grouped together into five major land use groups. The original fifteen zoning categories and the resulting five major land use groups are shown in Table 5-1. The exposure assumptions for each land use group are described in Section 5.2. Once the land groups were determined, the exposure assumptions for each group were used to calculate the risk for each area. Through this process, a risk level was calculated for a land use group in each area.

Two other steps were evaluated after the risks were calculated for each land use group. First, the calculated risk was compared to a target risk of $1x10^{-6}$ for carcinogens. For noncarcinogens, a hazard index of 1.0 was used as the target. If risk for an area was equal to or lower than 10^{-6}, then the land use group for that area was further considered. If the risk did not meet the $1x10^{-6}$ level, then design and construction techniques and landscaping practices were assumed to be employed to reduce the risk to that level.

The second step considered subsurface conditions and historical land use. Data gathered from deeper soil borings (i.e., below four feet) and ground water samples indicated that the subsurface conditions in some areas could pose potential risks from future construction activities. This data was not used in the quantitative risk assessment since more detailed information on future excavation or building construction specifications were needed to evaluate the potential risk from exposure to soils greater than four feet deep. However, this data is considered pertinent in a qualitative sense to evaluate risk from potential exposures during future land use. An extra level of protection was thereby added to the quantitative assessment by lowering the land use group to a more restrictive one (e.g. less exposure time) when undesirable subsurface conditions or historical industrial use of an area were evaluated.

Table 5-1
City of Wyandotte Zoning Ordinance and
Major Land Use Groups
BASF Corporation - South Works
Wyandotte, Michigan

Zoning Categories		Land Use Group
RM-1A	Multiple Family Residential District	RESIDENTIAL
RA	One Family Residential District	
RT	Two Family Residential District	
RM-1	Multiple Family Residential District	
RM-2	Multiple Family Residential District	
RM-3	Multiple Family Residential District	
O-S	Office Service District	COMMERCIAL
B-1	Neighborhood Business District	
CBD	Central Business District	
B-2	General Business District	
I-1	Industrial District	INDUSTRIAL
I-2	Industrial District	
I-3	Industrial District	
RU	Recreation Unit District	RECREATIONAL
P-1	Vehicular Parking District	PARKING

When subsurface conditions were not an issue, then the highest available land use group was assigned to the area. The next lowest land use group was assigned if subsurface conditions were an issue. This evaluation was based on quantitative data and the best professional judgement. In essence, the evaluation served as a "reality check" by comparing the calculated risk with additional environmental data and historical site knowledge.

The remainder of Section 5 presents the results of the risk characterization for future residential, commercial, industrial, and parking land uses with a general statement regarding the recreational land use group.

5.2 Exposure Evaluation - Future Land Use

The exposure evaluation for future land use is the same approach as used in Section 3.4 for Scenario A - the current conditions. The Site compounds and the toxicological indices for these compounds are the same as previously discussed in Sections 3.2 and 3.3, respectively. However, the exposure assumptions and potentially exposed populations vary for each future land use. The differences are described below with a summary of the exposure pathways and population by scenario provided in Table 5-2. Each of these subsections describes only the risk calculation for each land use group. The two final steps in classifying an area are presented in Section 5.4.

Residential Use - Scenario B

This scenario assumed residential dwellings across the 84-acre Site with all age groups potentially being exposed. The standard parameters for exposure to soils and ground water are given in Table 5-3. Worst-case parameters for adults included inhalation of vapors from soils for 24 hours per day for 350 days per year for 30 years in the residence. Although public water would be required by the City, this scenario examined the installation of an unauthorized well and its use as a full-time potable water supply. The probability of installing a potable water well located in the low water yielding overburden at the Site is extremely low. This scenario was considered because 1) someone may install a well without the city's knowledge or approval and 2) regulatory agencies typically require a ground water future use scenario in risk assessments. Inclusion of ground water as potable water had a minor impact on the risk calculations when compared to soil exposure.

Table 5-2
Exposure Pathways and Affected Population
for Each Scenario
BASF Corporation - South Works
Wyandotte, Michigan

Scenario	Pathways	Population
A - Current	Dermal contact, inhalation, incidental ingestion - Detroit River	Adults, Children 2-6, Children 6-12
	Dermal contact, inhalation, incidental ingestion - Site soils	Adults, Children 2-6, Children 6-12
B - Residential	Dermal contact, inhalation, incidental ingestion - Site soils	Adults, Children 2-6, Children 6-12
	Dermal contact, inhalation, ingestion - ground water	
C - Commercial	Dermal contact, inhalation, incidental ingestion - Site soils	Adults, Children 2-6
D - Industrial	Dermal contact, inhalation, incidental ingestion - Site soils	Adults
E - Parking	Inhalation - Site soils	Adults, Children 2-6, Children 6-12

Table 5-3
Standard Parameters Used for Calculation of Intake
Future Residential Conditions
BASF Corporation - South Works
Wyandotte, Michigan

PARAMETER		Standard Value		
		Adult	Child age 6-12	Child age 2-6
Physical Characteristics				
Average Body Weight	(a)	70 kg	29 kg	16 kg
Surface Area Available for Dermal Exposure	(a)	18,150 sq cm	10,420 sq cm	7,200 sq cm
Activity Characteristics				
Amount of Water Ingested	(a)	2 liters/day	2 liters/day	1 liter/day
Amount of Air Breathed	(a)	3.3 cu m/hr	2.6 cu m/hr	2.1 cu m/hr
Amount of Soil Ingested Daily (Incidental)	(b)	0.1 g	0.1 g	0.2 g
Duration of Inhalation Exposure	(a)	24 hrs	24 hrs	24 hrs
Duration of Soil Contact	(c)	4 hrs/day	4 hrs/day	1 hr/day
Frequency of Soil Contact	(c)	350 days/yr	350 days/yr	350 days/yr
Percentage of Skin Area Contacted by Soils	(a,c)	10%	10%	10%
Absorption Via Dermal Contact	(a)	100%	100%	100%
Absorption Via Incidental Ingestion	(a)	100%	100%	100%
Absorption Rate of Inhaled Air	(a)	100%	100%	100%
Duration at Residence	(a)	30 yrs	18 yrs	18 yrs
Lifetime	(a)	75 yrs	75 yrs	75 yrs
Amount of Air Breathed During Showering	(e)	0.83 cu m/hr	0.46 cu m/hr	0.25 cu m/hr
Percentage of Surface Area Immersed During Shower	(e)	100%	100%	100%
Length of Exposure While Showering	(e)	10 min	10 min	10 min
Length of Additional Exposure After Showering	(e)	10 min	10 min	10 min
Volume of Shower Stall	(e)	3 cu m	3 cu m	3 cu m
Volume of Bathroom	(e)	10 cu m	10 cu m	10 cu m
Volume of Water Used While Showering	(e)	100 liters	100 liters	100 liters
Bathing Frequency	(c)	350 d/yr	350 d/yr	350 d/yr
Material Characteristics				
Dust Adherence (Potting Soil)	(a)	1.45 mg/sq cm	1.45 mg/sq cm	1.45 mg/sq cm
Mass Flux Rate (water-based)	(d)	0.5 mg/sq cm/hr	0.5 mg/sq cm/hr	0.5 mg/sq cm/hr

a) Exposure Factors Handbook, EPA, 1989a
b) EPA 1989 Memorandum
c) ERM Staff Professional Judgement Based on Site Conditions
d) Superfund Exposure Assessment Manual, EPA 1988a
e) Symms, 1987

These exposure parameters defined the subchronic (i.e., short-term) and chronic (i.e., long-term) exposure characteristics for each route of exposure as presented in Table 5-4. The resultant intakes were calculated using these exposure characteristics, the concentration of each Site compound, and the toxicity of the compound as described previously. The detailed intake tables for future residential use are given in Appendix K under Scenario B.

Commercial Use - Scenario C

Future commercial use of the Site considered an adult workforce with a meeting place for children ages 6-12 after school and during the summer. This scenario was similar to the residential land use scenario except that 1) children ages 2-6 were not considered, 2) ground water exposure was not evaluated since commercial establishments would have public water and sewers, and 3) exposure assumptions were based on an eight-hour day for adults with less exposure time for children ages 6-12. The standard parameters for future commercial use are outlined in Table 5-5 with subchronic and chronic exposure characteristics presented in Table 5-6. The resultant intakes and detailed tables are presented in Appendix K under Scenario C.

Further caution is added for the commercial land use group. The City of Wyandotte Zoning Ordinance states that commercial development can include nursing homes, schools, day care centers, etc. These uses are not deemed appropriate for the Site given its history, environmental conditions, and the fact that residential dwelling was inappropriate for a majority of the Site. The commercial exposure assumptions were for adults who worked eight hours per day and limited exposure by older children. The risks would increase significantly if sensitive populations, such as the elderly, infants, and small children, were present for that time period.

Industrial Use - Scenario D

The exposure scenario for future industrial use of the Site was identical to Scenario C - future commercial use except that children ages 6-12 were not considered as a potentially exposed population. Table 5-7 lists the standard parameters established for this scenario, while Table 5-8 outlines the subchronic and chronic exposure characteristics used in calculating the resultant intakes. The resultant intake tables are provided in Appendix K under Scenario D.

Table 5-5
Standard Parameters Used for Calculation of Intake
Future Commercial Conditions
BASF Corporation - South Works
Wyandotte, Michigan

PARAMETER		Standard Value	
		Adult	Child age 6-12
Physical Characteristics			
Average Body Weight	(a)	70 kg	29 kg
Surface Area Available for Dermal Exposure	(a)	18,150 sq cm	10,420 sq cm
Activity Characteristics			
Amount of Air Breathed	(a)	3.3 cu m/hr	2.6 cu m/hr
Amount of Soil Ingested Daily (Incidental)	(b)	0.1 g	0.1 g
Duration of Soil Contact	(c)	8 hrs/day	3 hrs/day
Frequency of Soil Contact	(c)	260 days/yr	100 days/yr
Percentage of Skin Area Contacted by Soils	(a,c)	10%	10%
Absorption Rate of Compounds	(a)	100%	100%
Absorption Via Dermal Contact	(a)	100%	100%
Absorption Via Incidental Ingestion	(a)	100%	100%
Absorption Rate of Inhaled Air	(a)	100%	100%
Working Duration		30 yrs	-
Lifetime		75 yrs	75 yrs
Material Characteristics			
Dust Adherence (Potting Soil)	(a)	1.45 mg/sq cm	1.45 mg/sq cm
Mass Flux Rate (water-based)	(d)	0.5 mg/sq cm/hr	0.5 mg/sq cm/hr

a) Exposure Factors Handbook, EPA, 1989a
b) EPA 1989 Memorandum
c) ERM Staff Professional Judgement Based on Site Conditions
d) Superfund Exposure Assessment Manual, EPA 1988a

Table 5-6
Characteristics of Subchronic and Chronic Exposure Scenarios
Future Commercial Conditions
BASF Corporation - South Works
Wyandotte, Michigan

ROUTE OF EXPOSURE	MEDIA	SCENARIO	ACTIVITY	POPULATION	EXPOSURE CHARACTERISTICS	CHRONIC EXPOSURE CHARACTERISTICS
Ingestion	Soils	Actual	Incidental Ingestion	Child age 6-12 Adult	Ingestion of 100 mg daily at maximum concentration	Ingestion of 100 mg daily at average concentration
Dermal	Soils	Actual	Casual contact	Child age 6-12	Three hours of exposure (10% of body) at maximum concentration	One exposure event (10% of body) per day, 100 days/year at average concentration
				Adult	Eight hours of exposure (10% of body) at maximum concentration	One exposure event (10% of body) per day, 260 days/year at average concentration
Inhalation	Soils	Actual	Vapors	Child age 6-12	Three hours of exposure at the maximum calculated concentration	One exposure event per day for 100 days/ year at average calculated concentration
				Adult	Eight hours of exposure at the maximum calculated concentration	One exposure event per day for 260 days/ year at average calculated concentration

Table 5-7
Standard Parameters Used for Calculation of Intake
Future Industrial Conditions
BASF Corporation - South Works
Wyandotte, Michigan

PARAMETER		Standard Value Adult
Physical Characteristics		
Average Body Weight	(a)	70 kg
Surface Area Available for Dermal Exposure	(a)	18,150 sq cm
Activity Characteristics		
Amount of Air Breathed	(a)	3.3 cu m/hr
Amount of Soil Ingested Daily (Incidental)	(b)	0.1 g
Duration of Soil Contact	(c)	8 hrs
Frequency of Soil Contact	(c)	260 days/yr
Percentage of Skin Area Contacted by Soils	(a,c)	10%
Absorption Rate of Compounds	(a)	100%
Absorption Via Dermal Contact	(a)	100%
Absorption Via Incidental Ingestion	(a)	100%
Absorption Rate of Inhaled Air	(a)	100%
Working Duration		30 yrs
Lifetime		75 yrs
Material Characteristics		
Dust Adherence (Potting Soil)	(a)	1.45 mg/sq cm

a) Exposure Factors Handbook, EPA, 1989a
b) EPA 1989 Memorandum
c) ERM Staff Professional Judgement Based on Site Conditions

Table 5-8
Characteristics of Subchronic and Chronic Exposure Scenarios
Future Industrial Conditions
BASF Corporation - South Works
Wyandotte, Michigan

ROUTE OF EXPOSURE	MEDIA	SCENARIO	ACTIVITY	POPULATION	SUBCHRONIC EXPOSURE CHARACTERISTICS	CHRONIC EXPOSURE CHARACTERISTICS
Ingestion	Soils	Actual	Incidental Ingestion	Adult	Ingestion of 100 mg daily at maximum concentration	Ingestion of 100 mg daily at average concentration
Dermal	Soils	Actual	Casual contact	Adult	Eight hours of exposure (10% of body) at maximum concentration	One exposure event (10% of body) per day, 260 days/year at average concentration
Inhalation	Soils	Actual	Vapors	Adult	Eight hours of exposure at the maximum calculated concentration	One exposure event per day for 260 days/ year at average calculated concentration

Table 5-9
Standard Parameters Used for Calculation of Intake
Future Parking Conditions
BASF Corporation - South Works
Wyandotte, Michigan

PARAMETER		Standard Value		
		Adult	Child age 6-12	Child age 2-6
Physical Characteristics				
Average Body Weight	(a)	70 kg	29 kg	16 kg
Surface Area Available for Dermal Exposure	(a)	18,150 sq cm	10,420 sq cm	7,200 sq cm
Activity Characteristics				
Amount of Air Breathed	(a)	3.3 cu m/hr	2.6 cu m/hr	2.1 cu m/hr
Duration of Soil Contact	(b)	1 hr/day	1 hr/day	1 hr/day
Frequency	(b)	350 days/yr	350 days/yr	350 days/yr
Absorption Rate of Compounds	(a)	100%	100%	100%
Absorption Rate of Inhaled Air	(a)	100%	100%	100%

a) Exposure Factors Handbook, EPA, 1989a
b) ERM Staff Professional Judgement Based on Site Conditions

Table 5-10
Characteristics of Subchronic and Chronic Exposure Scenarios
Future Parking Conditions
BASF Corporation - South Works
Wyandotte, Michigan

ROUTE OF EXPOSURE	MEDIA	SCENARIO	ACTIVITY	POPULATION	SUBCHRONIC EXPOSURE CHARACTERISTICS	CHRONIC EXPOSURE CHARACTERISTICS
Inhalation	Soils	Actual	Vapors	Child age 2-6 Child age 6-12 Adult	One hour of exposure at the maximum calculated concentration	One exposure event per day for 350 days/ year at average calculated concentration

Parking Use - Scenario E

Parking is one of the land use categories in the City of Wyandotte Zoning Ordinance. An exposure evaluation was conducted to determine if parking areas would pose any threat to human health. The scenario is that volatile compounds in the soils could off-gas through cracks or breaks in the paving. These vapors could be inhaled under any of the aforementioned scenarios by all three age groups. The standard parameters used in evaluating this scenario are presented in Table 5-9 and the inhalation subchronic and chronic exposure characteristics are outlined in Table 5-10. The resultant intakes for future parking use were calculated and the detailed tables are presented in Appendix K under Scenario E.

Recreational Use

Recreation is also a land category in the ordinance. However, exposure assumptions for this land use are too diverse to adequately calculate a risk or hazard. Lack of specific information related to the type of recreation, time spent at the activity, age groups involved, etc. prohibited the calculation of a potential risk. However, the potential risk from recreational activities should be less than commercial or industrial scenarios because the length of time spent at the recreational activity is less than a workplace environment. The potential risks would not be as low as the parking scenario because time spent in Scenario E is minimal. Therefore, the assumption made under future recreational use was that potential risks would meet the $1x10^{-6}$ target level providing 1) exposure was shorter than workers (e.g., 8 hours/day, 350 days/yr for 30 years), 2) the activity does not disturb the land surface below four feet, and 3) the protective cover of grass, paving, asphalt, concrete, etc. eliminates contact with impacted soils and ground water.

The resultant intakes for each scenario were used in the risk characterization section to determine potential risks or hazards from future exposure.

5.3 Risk Characterization - Future Land Use

5.3.1 Comparison to Potentially Applicable or Relevant and Appropriate Requirements (ARARs)

The comparison of actual concentrations detected on site with ARARs is the same as the comparison presented in Section 3.5.2. Concentrations were assumed not to change for the future risk

characterizations. This assumption may overestimate the risk because the concentrations of compounds should decrease with time.

5.3.2 Noncarcinogenic Hazard Index - Future Use

Residential

Subchronic and chronic exposure for adults, children 6-12, and children 2-6 are dermal contact with soils; inhalation of vapors and volatilized compounds from soils; and incidental ingestion of soils. This scenario assumed that impacted soil was available for direct contact. No soil cover beyond the existing materials was assumed for any of the land use group scenarios. In addition, ground water exposure pathways (e.g., inhalation of and dermal contact with compounds during showering; and ingestion of ground water) were examined for Areas 1, 3, 5, 9, 11, 12, and 13. Monitor wells installed by ERM were located in these areas. The noncarcinogenic hazards for the residential land use per area are presented in Appendix K. The hazard indices for subchronic and weighted chronic cases are summarized on Table 5-11. All hazard indices except those indices for Areas 6, 10, 11, and 15 exceeded one, which is EPA's guideline.

If a hazard index exceeded one, then the hazard index was recalculated. Each compound affects different systems or organs in the human body. The hazard index was recalculated by summing the hazard indices for those compounds affecting the same organ. For example, trichloroethene affects the liver while lead affects the brain. One hazard index would be calculated for trichloroethene and a second one for lead. The total hazard index for the area would still exceed one, but the hazard index for each separate compound may not exceed one. This process results in a more accurate presentation of a hazard, as it does not assume affects on target organs are additive. In cases where each compound did not exceed one, the area was considered not to exceed one. The target organs for each compound were listed on Table 3-3.

The recalculated hazards for the residential land use group are summarized in Table 5-11 with the compound responsible for the exceedance given in parenthesis. The detailed calculations are given in Appendix K. Since the hazard index in Area 16 exceeded one when all of the compounds were summed, the hazard index was recalculated for each individual compound. The individual hazard indices did not exceed one. Therefore, Area 16 did not pose a short term or long term hazard from exposure (i.e., recalculated hazard indices were less than one).

Table 5-11
Summary of Reasonable Hazard Analysis for Soil and Air Exposure
Future Land Uses
BASF Corporation - South Works
Wyandotte, Michigan

Area	A - Current*	B - Residential		C - Commercial		D - Industrial		E - Parking
1	0.00447**	**2.07**	(Lead)	0.806		0.725		0
		1.82	(Lead)					
2	0.0302	**8.65**	(Lead)	**5.44**	(Lead)	**4.89**	(Lead)	2.49E-11
		8.48	(Lead)					
3	0.309	**16.7**	(Lead)	**10.5**	(Lead)	**9.44**	(Lead)	4.91E-09
4	0.00943	**2.70**	(Lead)	**1.70**	(Lead)	**1.53**	(Lead)	1.36E-09
5	0.0592	**17.0**	(Lead)	**10.7**	(Lead)	**9.59**	(Lead)	7.25E-09
6	0	0		0		0		0
7	0.00632	**2.33**	(Lead)	**1.16**	(<1)	0.987		4.35E-12
8	0.00146	0.418		0.263		0.236		3.74E-12
9	0.0163	**4.68**	(Lead, Mercury)	**2.94**	(Lead)	**2.64**	(Lead)	1.77E-12
10	0.000361	0.104		0.0651		0.0586		5.32E-12
11	0.00206	0.0638		0.372		0.334		4.90E-10
12	0.0312	**11.1**	(Lead, Mercury)	**5.62**	(Mercury)	**5.05**	(Mercury)	2.70E-12
13	0.0181	**17.6**	(Lead)	**3.12**	(Lead)	**2.84**	(Lead)	1.23E-07
14	0.00907	**2.51**	(Lead)	**1.58**	(Lead)	**1.42**	(Lead)	7.60E-08
15	0.000731	0.208		0.131		0.118		8.47E-11
16	0.00528	**1.51**	(<1)	0.951		0.855		7.06E-12

Target value = 1
Bold format means exceedance of target value, one.
*Current conditions evaluated a population trespassing on site only.
**Values presented are the sum of all selected noncarcinogenic compounds. When the summed hazard index exceeds one, then the exposure routes for each individual compound is summed.
( ) - Compound responsible for the hazard exceeding one.
(<1) - When individual compounds are summed, no compound exceeds a hazard index of one.

Dermal contact with lead detected in the soils, primarily by adults, was the exposure route and compound leading to a hazard index greater than one. Average lead concentrations were used in these calculations, with only Area 2 exceeding EPA's highest soil guideline of 1,000 ppm. Lead was detected in the upper one foot of the Site soils, which was predominantly the clay soil cover previously applied to the Site.

The probability that a person could contact the same contaminated area with elevated lead levels on a continuing basis for over 30 years is very low. Furthermore, any development of the Site would reduce the possibly contaminated surface area that could be contacted. Therefore, the hazards calculated herein represent overestimates of the actual and definitely the future hazards associated with each area.

Commercial

The same soil exposure pathways were evaluated under future commercial land use. Again, no additional soil covers were assumed and impacted soils were available for contact. However, the ground water pathways and children ages 2 to 6 as an exposed population were not evaluated. The noncarcinogenic hazards for the future commercial land use are presented in Appendix K with the results summarized in Table 5-11. All hazard indices except those for Areas 1, 6, 8, 10, 11, 15, and 16, exceeded EPA's guideline of one.

When each compound was recalculated based on target organ effects, Area 7 had a hazard index of less than one. Areas 2, 3, 4, 5, 9, 12, 13 and 14 had at least one compound that resulted in an exceedance of one, when the hazard index for recalculated for each compound. The principal exposure route responsible for the exceedances was dermal contact with lead detected in Site soils. Mercury soil concentrations led to the exceedance in Area 12. The same qualifying statements made under residential uses apply for commercial uses.

Industrial

The exposure routes and exposed populations were the same under industrial future use as in commercial use. Again, no additional soil covers were assumed and impacted soils were available for contact. The exception was that children ages 6 to 12 were not considered as an exposed population. The noncarcinogenic hazards for future industrial land use are summarized in Table 5-11 and presented in detail in Appendix K.

Areas 1, 6, 7, 8, 10, 11, 15, and 16 had hazard indices below one. Exceedance of EPA's guideline of one was noted in Areas 2, 3, 4, 5, 9, 12, 13, and 14. These areas had hazard indices greater than one even when the hazard index was recalculated for each compound based on target organ effects. As previously mentioned, dermal contact with exposed soils was the primary exposure route leading to the exceedances, with lead as the primary compound except in Area 12 (mercury). The same qualifying statements apply to industrial uses as to the previous land uses.

Parking

The hazard assessment under future parking land use examines only inhalation exposure from soils by all age groups. The noncarcinogenic hazard indices for the areas are presented in Table 5-11 with the area-specific tables given in Appendix K. All hazard indices were less than EPA's guideline of one by more than six orders of magnitude.

Recreational

Hazard indices were not calculated for this land use as discussed in Section 5.2 The hazards are anticipated to be no worse than a commercial setting (e.g., eight hours per day), but are expected to be higher than the parking land use (e.g., more than one hour per day). Specific hazards would depend upon the type of recreational activity occurring across the Site. Therefore, the assumption was made that the hazards for each area would be less than one, given less exposure time, and maintenance of the cover material which eliminates contact.

5.3.3 Carcinogenic Risk - Future Use

All of the carcinogenic risks calculated for the land use groups represent existing site concentrations detected in soil and ground water samples. The risks were calculated based on various exposure times and exposed populations for each land use group.

Residential

The chronic exposure for adults, children 6-12, and children 2-6 involved dermal contact with soils; inhalation of vapors and volatilized contaminants from exposed soils; and the incidental ingestion of soils. Additionally, risks were calculated for ground water exposure in Areas 1, 3, 5, 9, 11, 12, and 13. The carcinogenic risk for the 16 areas was calculated and is presented in Appendix K. The lifetime-weighted

Table 5-12
Summary of Risk Analysis for Soil and Air Exposures
Future Land Uses
BASF Corporation - South Works
Wyandotte, Michigan

Area	A - Current	B - Residential	C - Commercial	D - Industrial	E - Parking
1	8E-09	2E-07	9E-08	8E-08	2E-12
2	**1E-05**	***4E-03*** (Arsenic)	***3E-03*** (PNAs)	***2E-03*** (Arsenic, PNAs)	6E-10
3	5E-07	***2E-04*** (TCE)	7E-05	**6E-05**	9E-11
4	**2E-06**	***3E-04*** (PNAs)	***2E-04*** (PNAs)	***2E-04*** (PNAs)	2E-10
5	**2E-06**	***1E-03*** (PNAs, PCBs)	***7E-04*** (PCBs)	***6E-04*** (PNAs, PCBs)	4E-11
6	***1E-03*** (BCE)	***2E-04*** (BCE)	***1E-04*** (BCE)	**8E-05**	2E-07
7	1E-06	***4E-04*** (PNAs)	***2E-04*** (PNAs)	***2E-04*** (PNAs)	4E-11
8	**2E-06**	***6E-04*** (PCBs)	***4E-04*** (PCBs)	***3E-04*** (PCBs)	6E-13
9	**8E-06**	***4E-03*** (Arsenic, PNAs, PCBs)	***2E-03*** (Arsenic, PNAs, PCBs)	***2E-03*** (Arsenic, PNAs, PCBs)	3E-13
10	2E-07	**5E-06**	3E-06	**3E-06**	5E-11
11	3E-08	**2E-05**	4E-07	3E-07	7E-12
12	6E-07	***3E-04*** (PNAs, PCBs)	***2E-04*** (PNAs, PCBs)	***2E-04*** (PNAs, PCBs)	1E-11
13	**7E-06**	***5E-02*** (DCP, BCE)	***1E-03*** (DCP)	***1E-03*** (1,2-Dichloroethane)	3E-08
14	**4E-06**	***1E-03*** (PCBs)	***7E-04*** (PCBs)	***6E-04*** (PCBs)	2E-11
15	6E-07	***2E-04*** (PNAs)	**1E-04**	**1E-04**	2E-12
16	8E-09	8E-08	5E-08	4E-08	2E-12

Bold format means exceedance of target value, 1E-06
Italic format means exceedance of 1E-04
( ) - Compound leading to exceedance of 1E-04 risk level
BCE - bis(2-chloroethyl)ether
DCP - 1,2-dichloropropane

risks from future residential land use are summarized in Table 5-12. Figure 5-1 presents the carcinogenic risk results for the 16 areas.

The weighted carcinogenic risks ranged from $5x10^{-2}$ in Area 13 to $8x10^{-8}$ in Area 16. Only Areas 1 and 16 had carcinogenic risks lower than $1x10^{-6}$. Of the remaining areas, Areas 10 and 11 were within the EPA's risk range of $1x10^{-4}$ to $1x10x^{-6}$. The remaining areas exceeded the $1x10^{-4}$ risk level by factors ranging from 2 to 50. The primary exposure routes leading to these exceedances were dermal contact with and ingestion of compounds detected in exposed soils. The compounds responsible for the exceedance of $1x10^{-4}$ were arsenic, trichloroethene, PNAs, PCBs, 1,2-dichloropropane, bis(2-chloroethyl)ether, and 1,2-dichloroethane. PNAs and PCBs resulted in the majority of the exceedances. Additionally, ingestion of ground water contributed to the exceedance in those areas for which ground water data was available.

The probability that a person could contact the same contaminated area on a continuing basis for over 30 years is very low under any development scenario. The surficial materials would likely be redistributed and covered by grass, asphalt, or buildings and the lead levels would be reduced. Therefore, the risks calculated herein represent overestimations of the future risks associated with each area.

Commercial

The risk characterization for future commercial land use examined soil exposure routes for adults and children ages 6-12. The carcinogenic risks for the 16 areas are summarized in Table 5-12 and the detailed tables for each area are given in Appendix K. Figure 5-2 presents the carcinogenic risk results for the 16 areas.

The calculated risks ranged from $1x10^{-3}$ in Area 13 to $5x10^{-8}$ in Area 16. Areas 1, 11, and 16 had calculated risk lower than the $1x10^{-6}$ target value. Areas 3, 6, 10, and 15 had calculated risks within EPA's recommended range of $1x10^{-4}$ to $1x10^{-6}$. All other areas exceeded the $1x10^{-4}$ risk level by factors ranging from 2 to 10. Dermal contact with and incidental ingestion of exposed soils were again the primary exposure routes causing the exceedances. The previously mentioned qualifying statements also apply to this land use.

or Soil Exposure Pathways
iture Commercial Use Only
Based on Assumptions in Tables 3-12 and 5-7
ASF Corporation - South Works
Wyandotte, Michigan

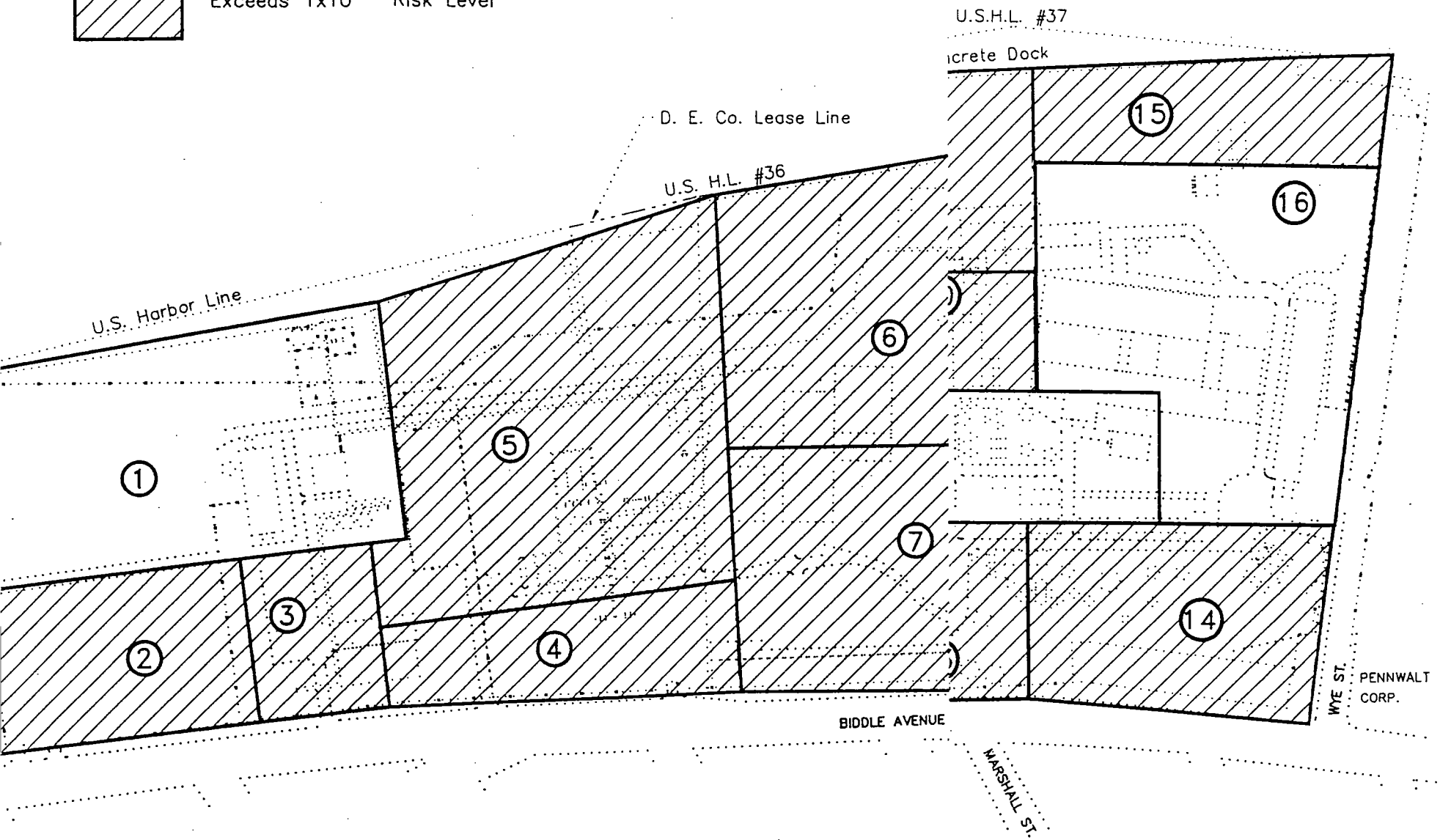
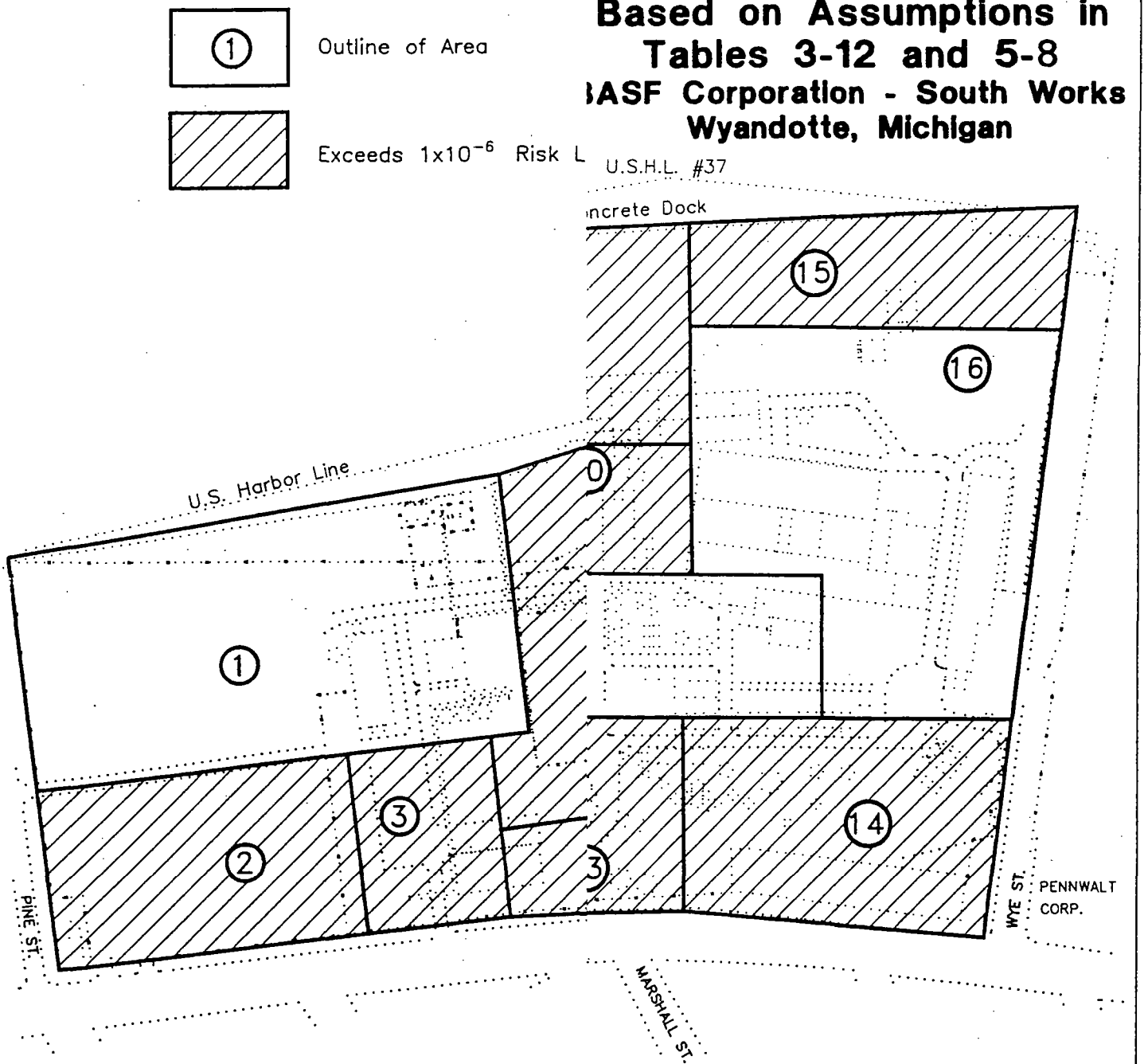


Figure 5-3
Risk Assessment Areas or Soil Exposure Pathways Future Industrial Use Only Based on Assumptions in Tables 3-12 and 5-8
BASF Corporation - South Works Wyandotte, Michigan



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Industrial

The future industrial land use scenario evaluated workplace exposures by adults. The risks for each area are summarized in Table 5-12 and presented in detail in Appendix K. Figure 5-3 presents the carcinogenic risk results for the 16 areas.

The risks calculated for each area ranged from $1x10^{-3}$ in Area 13 to $4x10^{-8}$ in Area 16. Areas 1, 11, and 16 had risks lower than $1x10^{-6}$, while the risks for Areas 3, 6, 10, and 15 were within EPA's recommended range. The remaining areas exceeded the $1x10^{-4}$ risk level by factors ranging from 2 to 10. As previously mentioned, the primary exposure routes responsible for the risk range exceedance were dermal contact with and incidental ingestion of PCBs, PNAs, arsenic, and 1,2-dichloroethane concentrations detected in exposed soil. The previously mentioned qualifying statements also apply to this land use.

Parking

The future parking scenario evaluated the inhalation of volatile compounds from soils by all age groups. The detailed tables are given in Appendix K with the summarized risk for each area presented on Table 5-12. Figure 5-4 presents the carcinogenic risk results for the 16 areas. The calculated risks ranged from $2x10^{-7}$ in Area 6 to $3x10^{-13}$ in Area 9. All calculated risks were less than the $1x10^{-6}$ target risk level.

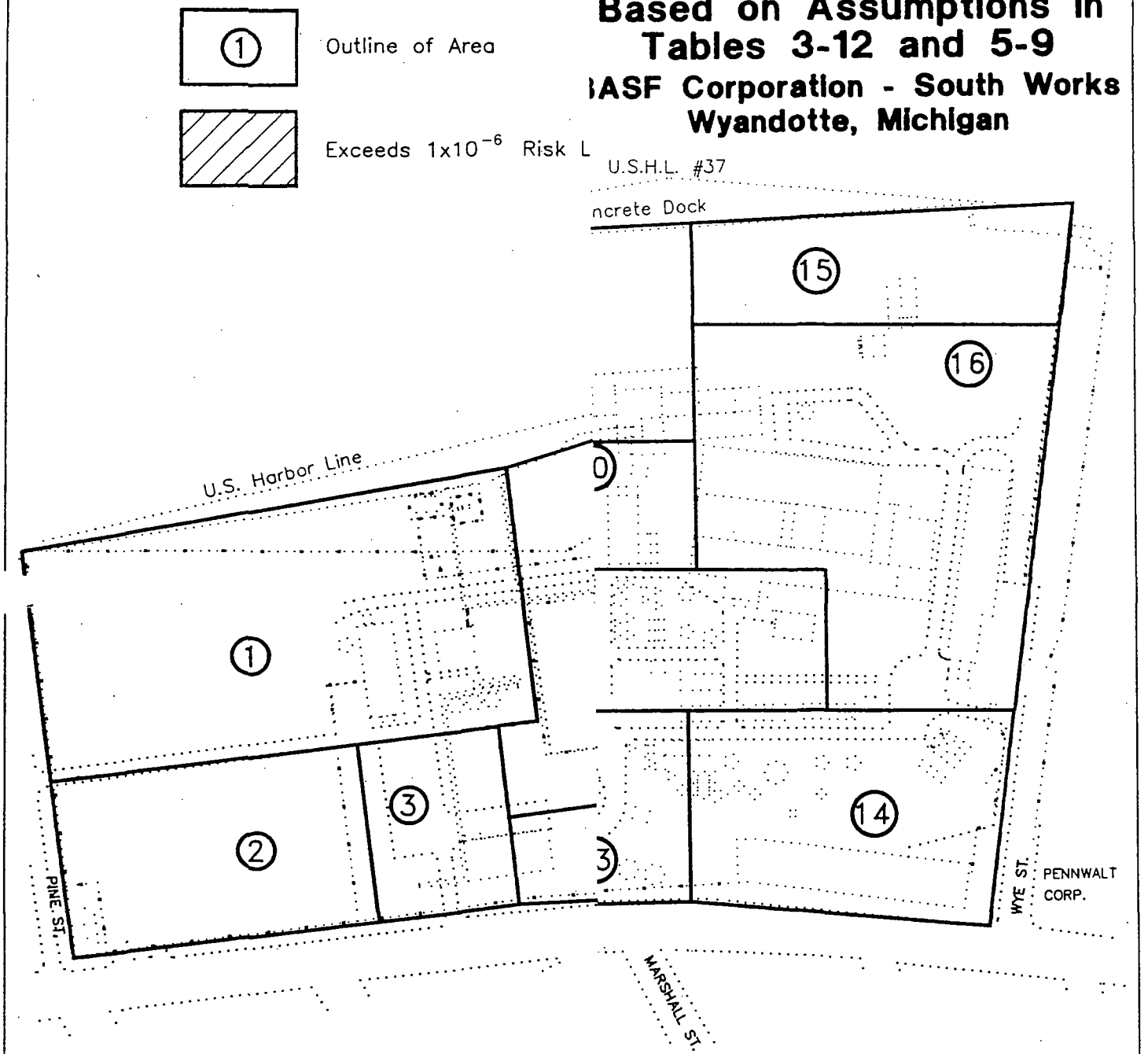
Recreational

As discussed in Section 5.2, risks from future recreational land uses were not calculated because the exposure times were dependent upon the type of recreational activity. The anticipated risk would be less than $1x10^{-6}$ because of less exposure time than in the future commercial land use scenario. Therefore, the risk from future recreational land uses are assumed to be closer to $1x10^{-6}$ than future commercial, because the exposure times would be lower and recreational activities would be seasonal.

5.4 Subsurface Conditions and Other Factors

Normally, a risk assessment is completed after the risks and hazards are calculated and risk management decisions are made. In this assessment, additional steps were added following the risk

Figure 5-4
Risk Assessment Areas or Soil Exposure Pathways Future Parking Use Only Based on Assumptions in Tables 3-12 and 5-9
BASF Corporation - South Works Wyandotte, Michigan



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characterization by land use group as depicted in Figure 3-2. These two steps are described in Section 5.1 and their significance to the South Works Site are addressed in this section.

The hazard indices and carcinogenic risks for each land use group assuming that impacted soils were still exposed were presented in Tables 5-11 and 5-12, respectively. Two other steps were employed to determine the final land use group for each area. First, the risk values were checked to see which areas met the $1x10^{-6}$ risk level. If an area exceeded the $1x10^{-6}$ level, then design and construction factors were imposed, such that development would reduce the exposures to contaminated soils (e.g., 0 to 4 feet). These design and construction factors were not detailed, but could consist of actions or designs, such as dust suppressants to minimize fugitive dust emissions, covering and sealing the top soils with asphalt, concrete, or additional layers of soils, and review of construction designs to assure that the exposures responsible for the risks were minimized. The assumption was then made that these areas would meet the $1x10^{-6}$ risk level when the design and construction factors were applied. This assumption was considered valid because imposing design and construction factors would reduce or eliminate the direct contact with the impacted soils. The risks associated with routes of exposure other than dermal contact and incidental ingestion would be less than $1x10^{-6}$ without these factors imposed. Therefore, imposing the factors would reduce the overall risk to less than $1x10^{-6}$.

The second step evaluated deeper (greater than four feet in depth) soils sampling data, ground water sampling data, qualitative data collected, and historical information available for each area. While these factors were not used in the quantitative risk assessments, their consideration added an extra measure of safety to the assessment. Concentrations of compounds from deeper soil samples and in ground water samples were higher than those used in the quantitative RA for Areas 3, 4, 5, 9, 10, 11, 12, 13, 14, and 16. These areas were also locations of the majority of previous industrial activities. Hence, any land development in these areas was further restricted and the assigned land use groups reflected these environmental and historical concerns.

The Consent Decree with MDNR specifies that development of the property not interfere with operation of the recovery system. Therefore, all or portions of Areas 4, 5, 8, 9, 10, 15, and 16 were designated Green Space to allow rainwater to infiltrate the soils.

Area 1 was deemed suitable for residential development based solely on the quantitative risk assessment. The subsurface conditions and historical information also indicated that residential development was a suitable land use. However, the assigned land uses for adjacent areas on-site and the existing pumping station raised the issue about the appropriateness of a residential use. Therefore, any land use other than residential was proposed for this area.

Areas 2 and 13 were designated parking because of the environmental problems associated with the subsurface conditions and past historical activities. These observed conditions warranted the parking recommendation despite the conclusions reached from the risk calculation for these areas.

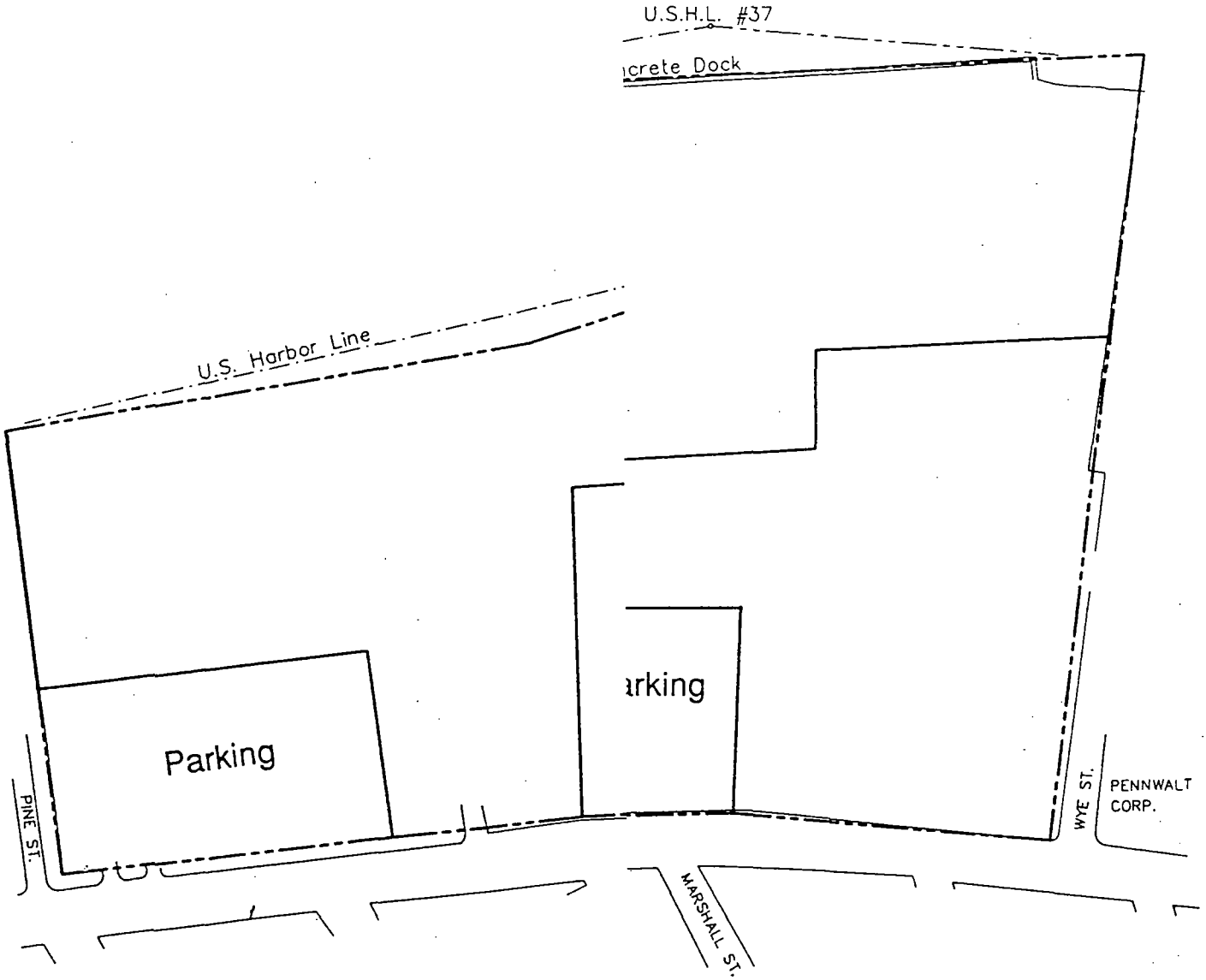
Areas 11, 12, 14, and 16 with previous heavy industrial use and subsurface environmental conditions of most concern were limited to commercial, industrial, or parking. Areas 3, 6, and 7 and those portions of Areas 5 and 8 not designated as greenspace are suitable for all land uses except residential.

Land use groups were assigned to each area following the evaluation of risk and the additional two steps. Individual areas with similar land use groups were noted and new boundaries were drawn as depicted on Figure 5-5.

Further caution is added for the commercial land use groups. The City of Wyandotte Zoning Ordinance states that commercial development can include nursing homes, schools, day care centers, etc. These uses are not deemed appropriate for the Site given its history, environmental conditions, and the fact that residential dwelling was inappropriate for a majority of the Site. The commercial exposure assumptions were for adults who worked eight hours per day. The risks would increase significantly if sensitive populations, such as the elderly, infants, and small children, were present for that time period.

Figure 5-5
Land Use Assessment
BASF Corporation - South Works
Wyandotte, Michigan

Based on Assumptions in Sections 3, 5, and 6



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